

# MiPlan:



Photo by Jorge R. Perez, City of Miami

## City of Miami Climate Action Plan

June 2008



The City of Miami  
Mayor Manuel A. Diaz



# MiPlan

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Acronyms And Abbreviations

|                        |   |
|------------------------|---|
| <b>BOMA</b>            | Building Owners and Manager’s Association     |
| <b>CO<sub>2</sub></b>  | Carbon dioxide                                |
| <b>CO<sub>2e</sub></b> | Carbon dioxide equivalents                    |
| <b>EPA</b>             | Environmental Protection Agency               |
| <b>FPL</b>             | Florida Power & Light Company                 |
| <b>ESCO</b>            | Energy service company                        |
| <b>USGBC</b>           | United States Green Building Council          |
| <b>HVAC</b>            | Heating, ventilating, and air conditioning    |
| <b>ICLEI</b>           | Local Governments for Sustainability          |
| <b>IPCC</b>            | Intergovernmental Panel on Climate Change     |
| <b>KWh</b>             | Kilowatt-hour                                 |
| <b>LED</b>             | Light-emitting diode                          |
| <b>LEED</b>            | Leadership in Energy and Environmental Design |
| <b>Mtoe</b>            | Million tons of oil equivalents               |
| <b>MWh</b>             | Megawatt-hour                                 |
| <b>ppm</b>             | Parts per million                             |
| <b>PV</b>              | Photovoltaic                                  |
| <b>SUV</b>             | Sports utility vehicle                        |
| <b>UN</b>              | United Nations                                |
| <b>VMT</b>             | Vehicle miles traveled                        |



## Executive Summary

The City of Miami sits on the frontline of man-made climate change. Over the next century, escalating greenhouse gas emissions threaten to dramatically increase the earth's temperatures and raise sea levels, making Greater Miami one of the most vulnerable urban areas in the world. If climate change proceeds unmitigated, living in Miami will become extremely difficult, if not impossible.

The City of Miami is committed to taking action to reduce and halt global climate change. Miami's greenhouse gas emissions currently exceed 4.8 million metric tons per year and will rise to 5.7 million metric tons by 2020 without action. MiPlan, the City of Miami's Climate Action Plan, outlines how the City will reduce greenhouse gas emissions to 25% below 2006 levels citywide by 2020 and to 25% below 2007 governmental levels by 2015. MiPlan represents a strong first step towards a sustainable future for Miami. The keystones of MiPlan focus on five main areas of sustainability:

- **Buildings:** Buildings are the source of more than half of Miami's greenhouse gas emissions. Buildings consume energy to provide basic functions such as cooling, lighting, heating water, running appliances and computers. Most buildings also waste energy, using 30% of their energy inefficiently or unnecessarily, according to the US EPA. Miami buildings are unique in that they consume almost all of their energy from electricity and use more of that energy for cooling than almost anywhere else in the US. *Miami will reduce annual greenhouse gas emissions by 975,000 metric tons by 2020 through improvements in energy efficiency in both new and existing buildings. This program will emphasize efforts to improve energy efficiency in existing buildings and their cooling and lighting systems, which together can comprise more than half of electricity used in a typical South Florida building.*
- **Energy sources:** Electricity supplies almost all of Miami's energy for buildings. More efficient generation and cleaner fuel sources of electricity can greatly reduce the City's greenhouse gas emissions. Although Miami's greenhouse gas emissions from electricity have been decreasing in recent years through the efforts of the City's utility (FPL), the City seeks to have that trend continue and accelerate. *Miami will reduce annual greenhouse gas emissions by 429,000 metric tons by increasing the use of renewable energy and the use of more efficient, local sources of power.*

- **Transportation:** The transportation sector, predominantly the use of cars and trucks, produces 40% of the City's greenhouse gas emissions. Shifting the means of transportation from single-occupant large cars and SUVs to more efficient cars or alternative methods of transportation can greatly decrease the City's greenhouse gas emissions. Miami-Dade County roads now see over 21 billion miles of driving per year, up 33% from 10 years ago. Increasing commute times and driver frustration heighten the need to improve transportation in the City. By increasing the number of transportation choices to residents and removing barriers to alternative transportation, MiPlan seeks to reduce automobile dependency. *Miami will reduce annual greenhouse gas emissions by 565,000 metric tons by 2020 by reducing vehicle miles traveled, increasing fuel efficiency, increasing the use of alternative transportation, and increasing the use of alternatively-fueled vehicles.*
- **Land use:** Land use contributes to energy consumption in both the building and transportation sectors. Denser, more walkable cities have lower automobile usage and are more energy efficient. Compact, pedestrian-friendly urban planning can contribute not only to decreased energy consumption but also provide sustainable communities for Miami's future. The City is projected to absorb another 50,000 residents by 2020 and the manner in which they are absorbed will impact the City's greenhouse gas emissions. *Miami will reduce annual greenhouse gas emissions by 148,000 metric tons by implementing more efficient land use planning and zoning.*
- **Adaptation:** Some amount of temperature increase and sea level rise is inevitable, even if greenhouse gas concentrations are stabilized at current levels. *Miami will begin to plan for the impacts of climate change and incorporate climate change scenarios into long-range planning.*

Climate change presents one of the greatest challenges of the 21<sup>st</sup> century, but there is hope for the global environment. As an international city, Miami has the opportunity to lead in developing innovative, sustainable solutions and pushing the frontiers of progress by initiating a program to implement energy efficiency improvements citywide. In doing so, Miami will provide a model that will reap the benefits of innovation through the growth of local green industries, by reducing dependence on foreign energy sources, and by creating a sustainable community that attracts families and businesses.

# 1.0 Introduction

For the City of Miami, South Florida and much of the world, increased climate change due to global warming is the most significant environmental problem of recent times. It will impact residents and visitors alike, with indiscriminant impacts on homes, businesses and public infrastructure. Many of the things that make Miami such a desirable place to live and to visit - its tropical weather, its lush green landscapes, the beaches to the east, and the Everglades to the west - are threatened by the effects of climate change. Rising sea levels have the potential to erode beaches, flood low-lying buildings, and contaminate drinking water.

Awareness of this wide-ranging threat has increased dramatically in recent years. In 2007, the Nobel Peace Prize was awarded jointly to Al Gore and the United Nation's Intergovernmental Panel on Climate Change (IPCC) for their work in the area of climate change. The IPCC's work summarizes scientific knowledge on greenhouse gases, their relationship to human activity, and the potential impacts of increasing concentrations of these gases on the earth, including rising temperatures and sea levels, melting glaciers, and changes in precipitation patterns. Scientific consensus now recognizes that most of these changes are due to human activities. As stewards for current and future generations, dramatic steps must be taken to radically reduce global emissions of greenhouse gases if future climate change is to be limited and its widespread impact on the City and State reduced.

No single government or municipality alone can halt climate change. The solution will require comprehensive, coordinated efforts at the local, state, regional, national, and international levels. The City of Miami must acknowledge the responsibility to lead by example, proactively reducing greenhouse gas emissions, and encouraging residents to do the same. The benefits, in addition to reducing emissions of greenhouse gases, include: reducing energy costs in the wake of skyrocketing costs of fossil fuels, decreasing dependence on other nations for energy supply, creating new jobs and industries in a green economy, and allowing for future sustainable development by providing a model that can be replicated nationwide.

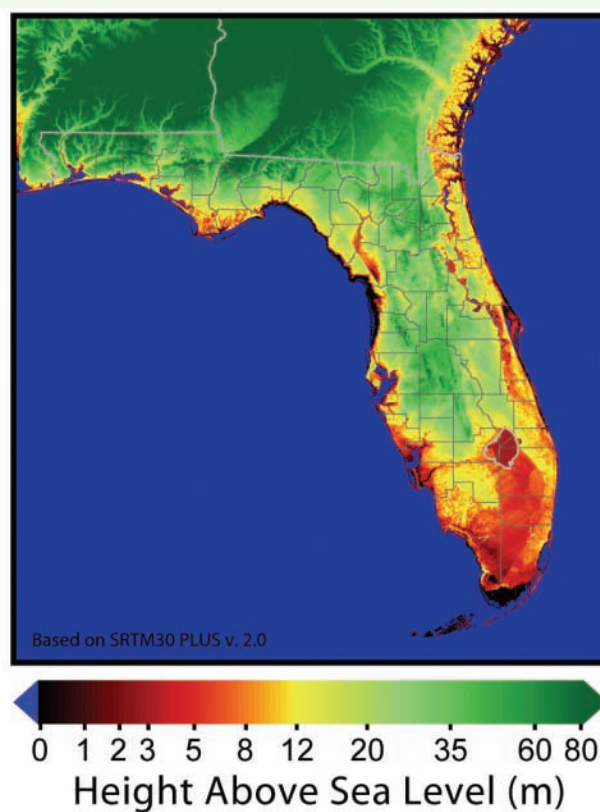
The City of Miami recognizes that the global threat of climate change demands a local response. In 2005, Mayor Manuel A. Diaz signed the US Mayor's Climate Protection Agreement, committing the City to dramatically reduce greenhouse gas emissions, and, in 2007, the City Commission officially adopted the agreement. In response, the City has prepared MiPlan (the City's Climate Action Plan) which provides the framework for local action to address climate change. The Plan includes a description of the impact of climate change on Miami (Section 2.0), baseline data on the City's greenhouse gas emissions (Section 3.0), reduction targets (Section 4.0), a plan to reduce those emissions (Section 5.0), and background information on the science of climate change (Appendix B). This plan is intended to reduce greenhouse gas emissions from both City government operations and the City as a whole. In the next year, the City will use this plan as the framework to develop a specific implementation and financing strategy. MiPlan provides the essential framework required for Miami's efforts to combat global climate change.

## 2.0 Impact on Miami

The City of Miami is located in Southeast Florida, in Miami-Dade County on the Miami River, with the Atlantic Ocean to the east and the Florida Everglades to the west. With a population of 404,048 as of 2006, Miami is the largest city in the greater South Florida area, which is home to 5.4 million people -- the largest metropolitan area in the Southeast US. Miami is a cosmopolitan community, with over half its population born outside the US. The City also attracts tourists from all over the world and is unique in its proximity to two national parks, Biscayne National Park and Everglades National Park.

Historically, Florida has been vulnerable to natural disasters primarily from hurricanes. In 1992, Hurricane Andrew devastated the Miami area, causing \$26.5 billion in damages. The unprecedented hurricane activity in the 2004 and 2005 seasons caused further impact to South Florida. Hurricane Wilma (2005) alone caused over \$1 billion in damages. Global warming will present a new and greater natural hazard to South Florida through rising sea levels and its impact on the land and drinking water supply. Due to its low elevation, averaging 72 inches (1.8 meters) above sea level, Miami is particularly vulnerable to rising sea levels, as shown in Figure 2.1.

### Sea Level Risks - Florida



**Figure 2.1:** Height above sea level across Florida in meters (1 meter equals 39 inches).<sup>1</sup>

<sup>1</sup> Robert A. Rhode, Global Warming Art, [http://www.globalwarmingart.com/wiki/Image:Florida\\_Sea\\_Level\\_Risks\\_png](http://www.globalwarmingart.com/wiki/Image:Florida_Sea_Level_Risks_png). Based on the public domain data set SRTM30 PLUS v.2.0, [http://topex.ucsd.edu/WWW\\_html/srtm30\\_plus.html](http://topex.ucsd.edu/WWW_html/srtm30_plus.html). This image is used and licensed under the Creative Commons Attribution-NonCommercial-ShareAlike License Version 2.5, <http://creativecommons.org/licenses/by-nc-sa/2.5/>.

In 1988, the United Nations (UN) established the Intergovernmental Panel on Climate Change (IPCC). The purpose of the IPCC was to provide policy makers worldwide with an objective overview of the state of scientific knowledge on climate change. In 2007, the IPCC released its Fourth Assessment Report.<sup>1</sup> The major projections of the 2007 report are that:

- Global temperatures will likely rise by between 2.0 and 11.5 degrees Fahrenheit by 2100;
- Sea levels are projected to rise by between 7 and 23 inches by 2100.

It should be noted that the IPCC estimates of sea level rise omitted the impact of melting icepack in Greenland and Antarctica because of concerns about uncertainty in available data and models. However, based on more recent information, other reports have projected substantially greater sea level rises. A task force of Miami area scientists has projected a sea level rise of at least 18 inches in the next 50 years and 36 to 60 inches by 2100.<sup>2</sup>

Due to Miami's low elevation and high density of buildings near the ocean, it has more property at risk from rising sea levels than any other City in the world. A study by the Organisation of Economic Cooperation and Development found that Greater Miami presently has over \$400 billion in property at risk from coastal flooding and by the year 2070 that value could rise to over \$3.5 trillion.<sup>4</sup> In addition to its property risk, the study also found that Greater Miami is one of the 20 cities with the most population at risk from coastal flooding.

A recent study by Elizabeth A. Stanton and Frank Ackerman of Tufts University ("Florida and Climate Change: The Costs of Inaction") assessed the potential economic impact of global warming on the State of Florida.<sup>5</sup> They reported that statewide the costs of inaction may reach \$27 billion in 2025 and \$345 billion by 2100. Their analysis assessed potential impacts to the tourism industry, increased hurricane strength, increased costs to the electricity systems, and the value of real estate at risk from sea level rise. The Tufts report does not include estimates of the impact of climate change on agriculture, fishing, insurance, transportation, and water. Inclusion of these impacts would substantially increase estimates of the costs of inaction. The report also projects that, unless steps are taken to reduce greenhouse gas emissions, by the year 2070 the sea level may rise 27 inches and 70% of Miami-Dade County would be vulnerable to flooding. With a sea level rise of that magnitude, life in Miami-Dade County would be extremely difficult.

Clearly, Miami is one of the most vulnerable cities to climate change in the world.

<sup>2</sup> IPCC, (2007), "Climate Change 2007: Synthesis Report. Summary for Policymakers." [http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr\\_spm.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf).

<sup>3</sup> Science and Technology Committee of the Miami Dade County Climate Change Advisory Task Force, (2008), "Statement on Sea Level in the Coming Century". [http://www.miamidade.gov/derm/library/08-10-04\\_CCATF\\_BCC\\_Package.pdf](http://www.miamidade.gov/derm/library/08-10-04_CCATF_BCC_Package.pdf).

<sup>4</sup> Nicholls, R. J. *et al.* (2008), "Ranking Port Cities with High Exposure and Vulnerability to Climate Extremes: Exposure Estimates", *OECD Environment Working Papers*, No. 1, OECD Publishing. doi:10.1787/011766488208. <http://www.oecd.org/dataoecd/16/58/39720578.pdf>.

<sup>5</sup> EA Stanton, F Ackerman (2007), "Florida and Climate Change the Costs of Inaction." Tufts University. [http://www.ase.tufts.edu/gdae/Pubs/rp/Florida\\_Ir.pdf](http://www.ase.tufts.edu/gdae/Pubs/rp/Florida_Ir.pdf).



## 3.0 Greenhouse Gas Inventory

### 3.1 Methods

The City of Miami has developed **MiPlan** (the City's Climate Action Plan) following the Cities for Climate Protection methodology developed by ICLEI, an international organization of local governments for sustainability. ICLEI includes over 1,000 members, with 350 members in the US. The Cities for Climate Protection Program includes a standard methodology, support from ICLEI staff, a handbook, and software for developing a Climate Action Plan. Specifically, the ICLEI climate action methodology consists of five steps:

1. **Inventory greenhouse gas emissions.** Compile an inventory of greenhouse gas emissions from both citywide activities and government activities.
2. **Target reductions.** Set target reduction levels for greenhouse gas emissions.
3. **Action items.** Develop action items to achieve targeted reductions in greenhouse gas emissions.
4. **Implementation.** Implement the action items.
5. **Monitoring.** Evaluate the reductions achieved by assessing changes in greenhouse gas emissions.

This document addresses the first three steps of the ICLEI process. The last two will be performed subsequent to the completion of this plan and are discussed in Sections 5.3 and 5.4 of this report.

The City's inventory was conducted by compiling the best available data on energy consumption and solid waste disposal, given the time frame and resources of the project, and is intended to identify the City's largest sources of greenhouse gas emissions. For citywide consumption data, city specific data was used where available. If City specific data was not available, relevant values were extrapolated by population ratios from County or State data.<sup>6</sup> For the government inventory, government specific data was obtained from vendors or City departments. In the case of solid waste from government buildings, very few records were kept and total volume was estimated based on the limited records available.<sup>7</sup> The data present in the following sections represents the best estimate of the City of Miami's greenhouse gas emissions given the available data sources.

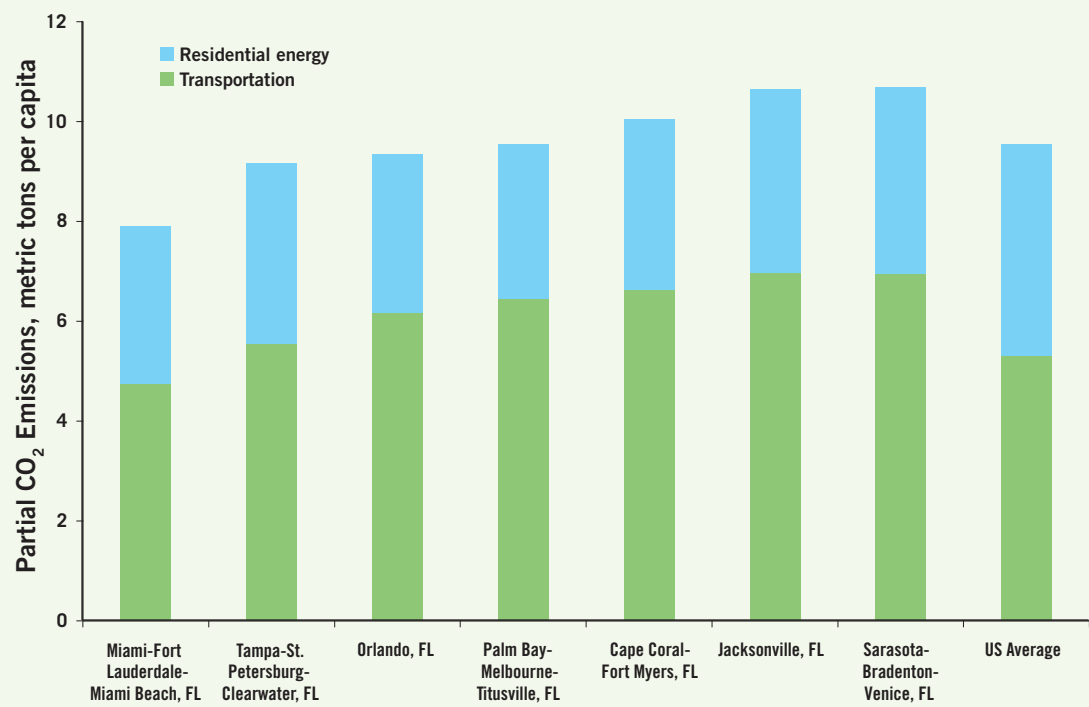
<sup>6</sup> Electricity consumption was compiled specifically for the City of Miami from utility provided records. Transportation fuel consumption and solid waste disposal were measured based on state records of county fuel consumption and solid waste generation. However, use of natural gas, propane, and other fuel oils was calculated based on prorated state consumption and may represent an overestimate of their use in Miami since there is very little use of these fuels for heating in Miami compared to the more northern parts of the state.

<sup>7</sup> The City of Miami has over a dozen haulers removing waste from City government facilities. These haulers typically collect City government waste as part of a route where waste from multiple sources are also collected. Hence, the waste solely due to the City of Miami could not be determined directly. Estimates of solid waste were compiled based on size of dumpsters, typical density of waste, and frequency of collection at City of Miami facilities, where available.

This inventory does not include the airport which lies outside the City boundary and is not included in the ICLEI protocol, or the shipping industry, except for activities accounted for in state fuel tax sales.

### 3.2 Citywide Greenhouse Gas Inventory

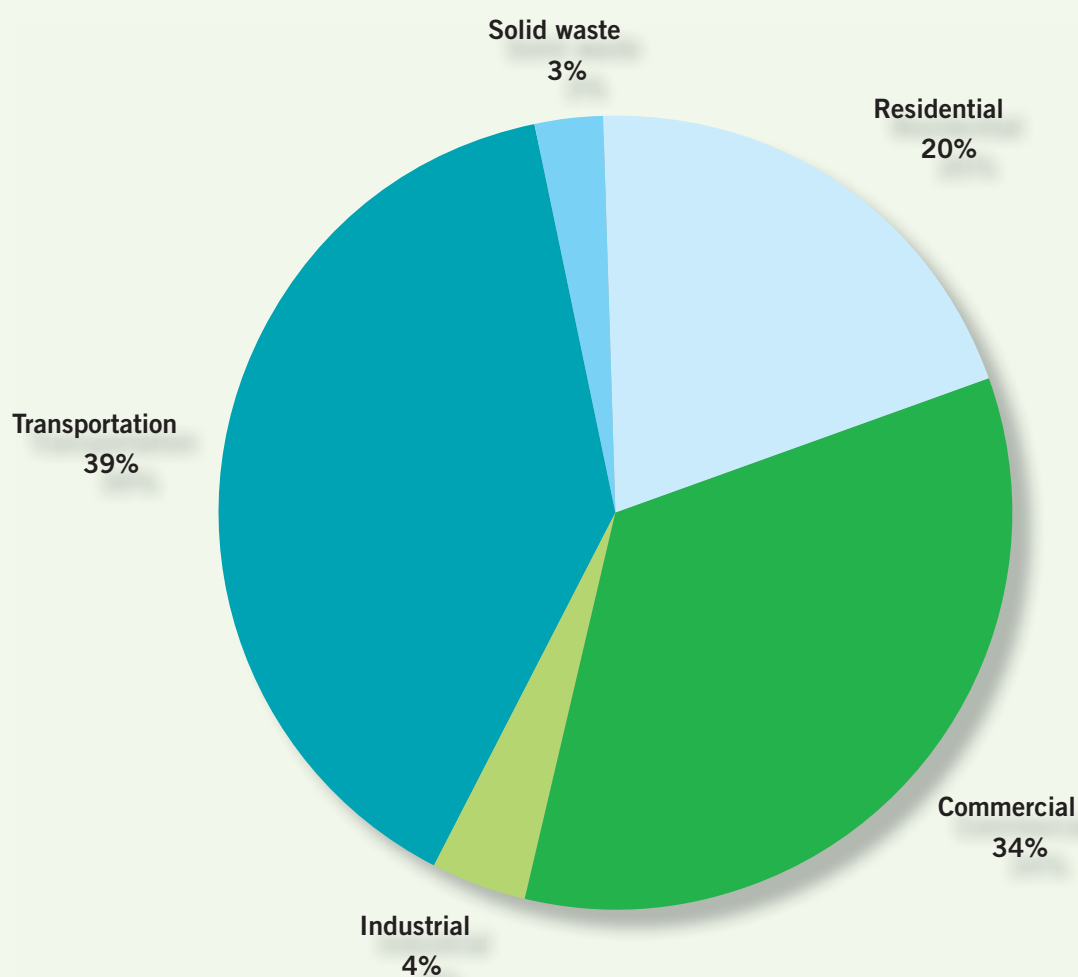
Greenhouse gas emissions were inventoried from the City of Miami as a whole following the ICLEI protocol. Based on this inventory, the total emissions from the City of Miami for the year 2006 were 4.8 million metric tons of carbon dioxide equivalents (CO<sub>2e</sub>). Comparing only greenhouse gas emissions from residential energy use and transportation, Miami's per capita emissions are in the lowest one-third of the 100 largest metropolitan areas in the US.<sup>8,9</sup> (Figure 3.1.) Miami's per capita emissions were less than all other listed Florida metropolitan areas and well below the US average.



**Figure 3.1:** Partial per capita greenhouse gas emissions at selected Florida metropolitan areas based on residential energy and transportation. Commercial and industrial energy consumption is excluded. Transportation includes only automobiles and trucks.<sup>10,11</sup>

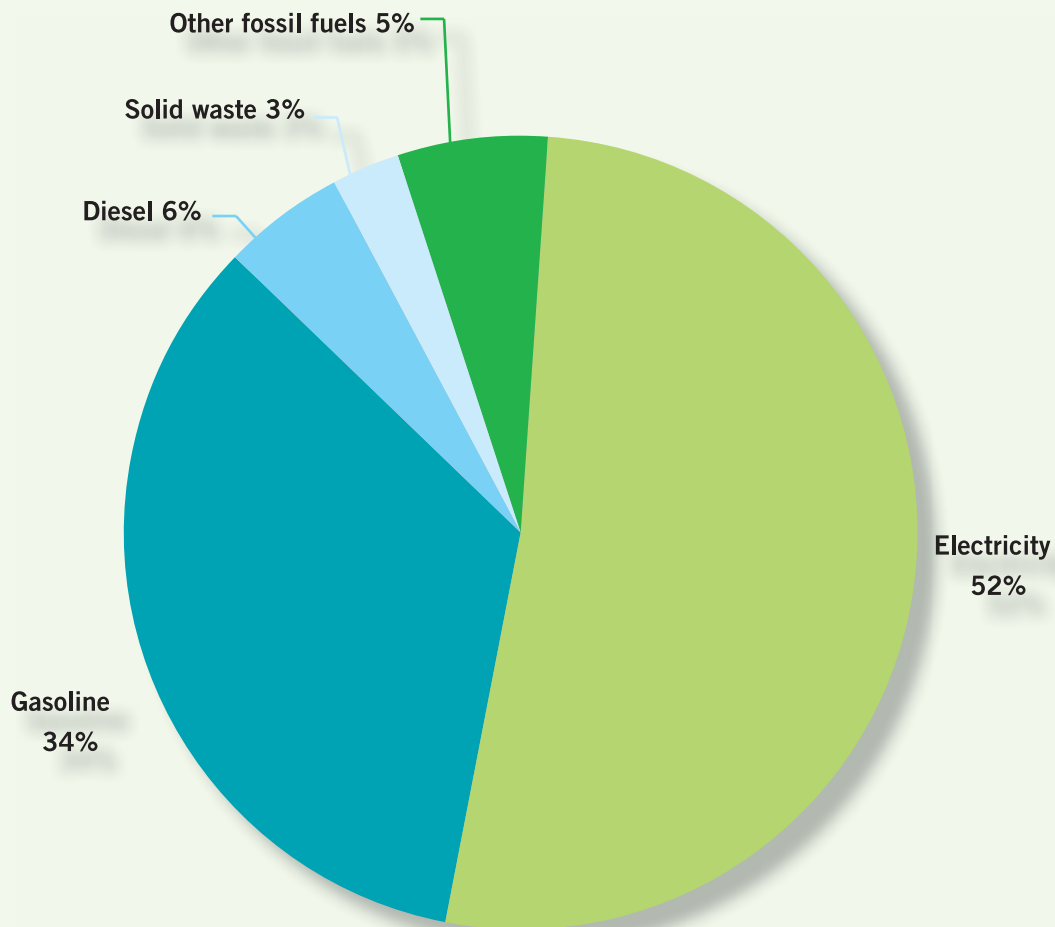
<sup>8</sup> MA Brown, F Southworth, A Sarzynski, (2008), "Shrinking the Carbon Footprint of Metropolitan America." Brookings Institute.  
<sup>9</sup> Per capita emissions can be a useful metric for measuring progress in reducing greenhouse gases and for comparing one community's emissions with neighboring cities and against regional and national averages. Dividing the total community-wide CO<sub>2e</sub> emissions by population yields a result of 11.8 metric tons of CO<sub>2e</sub> per capita. It is important to understand that this number is not the same as the carbon footprint of the average individual living in Miami and that the per capita values from the City's inventory are greater than those of the Brookings Institute due to differences in methodology.  
<sup>10</sup> F Southworth, A Sonnenberg, MA Brown, (2008). "The Transportation Energy and Carbon Footprint of the 100 Largest U.S. Metropolitan Areas." Georgia Tech, Ivan Allen College, Working Paper #37.  
<sup>11</sup> MA Brown, E Logan, (2008), "The Residential Energy and Carbon Footprint of the 100 Largest U.S. Metropolitan Areas." Georgia Tech, Ivan Allen College, Working Paper #39.

Almost all of the City's greenhouse gas emissions (over 90%) can be attributed to buildings and transportation. Figure 3.2 summarizes City greenhouse gas emissions by sector. The transportation sector accounts for 39% of the City's total emissions. The commercial sector produces 34% of the City's emissions and the residential sector produces 20%. The industrial sector in the City of Miami accounts for only 4% of CO<sub>2e</sub> emissions. Solid waste produces 3% of the City's emissions.



**Figure 3.2:** 2006 Citywide Miami greenhouse gas emissions by sector

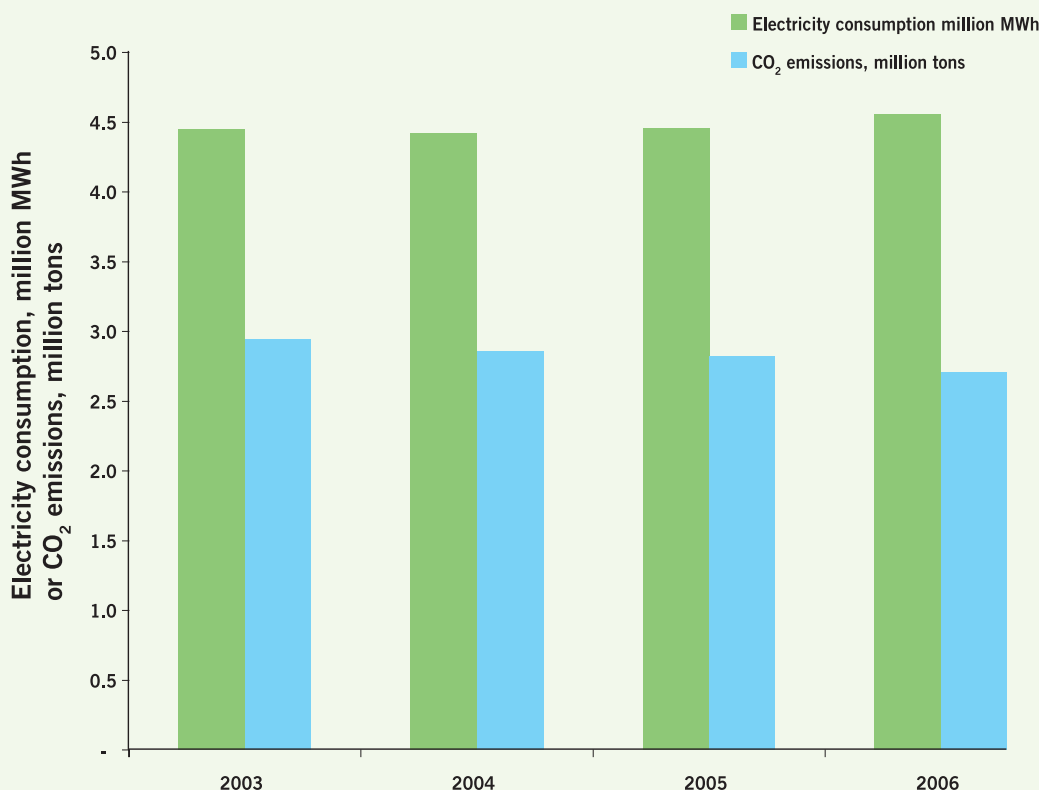
Figure 3.3 presents the City's greenhouse gas emissions by source. The majority of the emissions are due to electricity usage at 52%. Transportation fuels, gasoline and diesel, account for another 40%. Solid waste represents 3% of the City's emissions and other fossil fuels, propane, natural gas and light fuel oils, represent the remaining 5%.



**Figure 3.3:** 2006 Citywide Miami greenhouse gas emissions by source

Miami's profile of energy usage is unique in several respects. Miami's greenhouse gas emissions from electricity consumption have actually decreased in recent years despite increases in consumption. This decrease results from FPL's commitment to reduce its own emissions largely by switching to less carbon intensive<sup>12</sup> fuel sources. (Figure 3.4)

<sup>12</sup> Carbon intensity refers to the amount of carbon dioxide associated with a fuel source. Fuels with high carbon intensity, such as petroleum products, release greater quantities of CO<sub>2</sub>. Natural gas is less carbon intensive than petroleum fuels but more carbon intensive than most renewable energies.



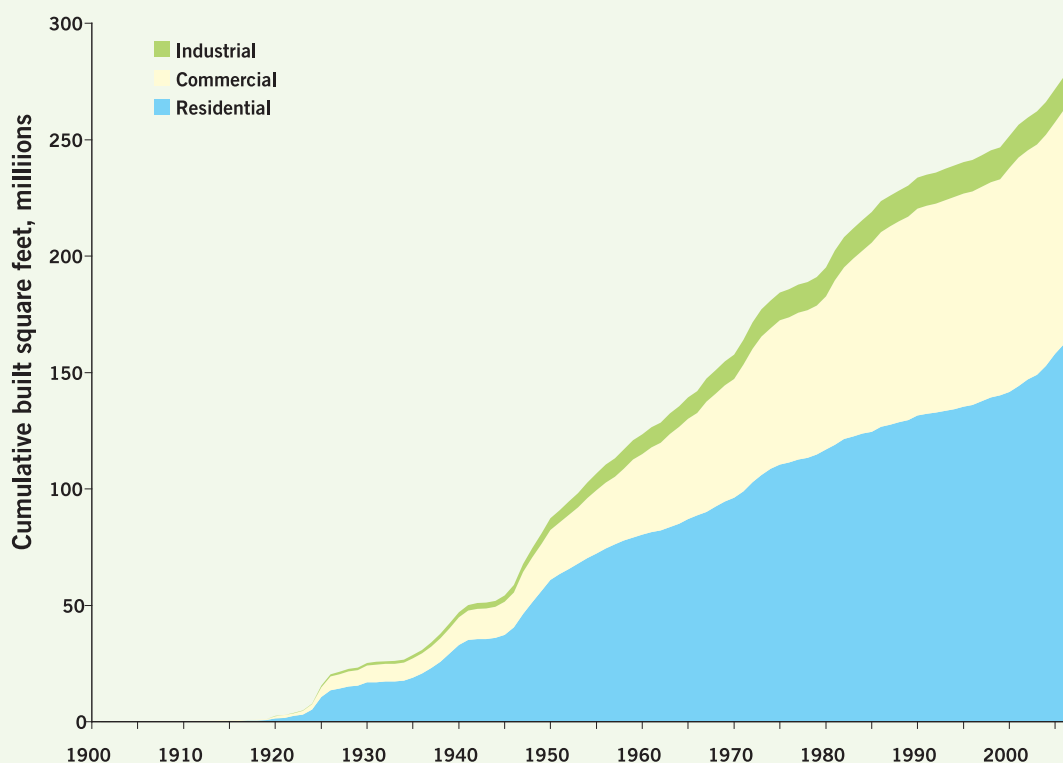
**Figure 3.4:** City of Miami electricity consumption and CO<sub>2</sub> emissions from electricity.

Over 90% of the energy for Miami buildings comes from electricity. Nationally, only 66% of residential energy comes from electricity with the remainder coming primarily from heating fuels such as natural gas, petroleum products and wood.<sup>13</sup> Miami's warm weather rarely requires heating and therefore South Florida has little use of heating fuels. In a typical residence in North Florida, cooling and heating consume 20 and 15% of energy usage, respectively, while in South Florida cooling consumes 40% and heating consumes only 2%.<sup>14</sup> Nationally, 47% of energy is used for heating and only 6% for cooling. In a typical South Florida residence, cooling, lighting, refrigeration and water heating account for 77% of electricity consumption. Miami's strategies for reducing energy consumption in buildings are unique in that they will focus almost exclusively on electricity and among electricity uses the largest focus will be on cooling.

<sup>13</sup> Energy Information Administration, US Department of Energy, (2001), "Residential Energy Consumption Survey". <http://www.eia.doe.gov/emeu/recs/contents.html>.

<sup>14</sup> Florida Solar Energy Center, "How Can Home Energy Efficiency Be Improved?" <http://www.fsec.edu/en/consumer/buildings/homes/ratings/improve.htm>.

Opportunities for energy efficiency improvements are greater in older buildings. Eighty percent of Miami's building stock is more than 20 years old and should be ripe for efficiency upgrades (Figure 3.5). Another opportunity for efficiency gains is in the commercial sector which holds 35% of the built square feet but consumes 60% of the City's electricity. Efficiency improvements in the commercial sector in Miami would have a greater impact per square foot on greenhouse gas emissions than in other sectors.

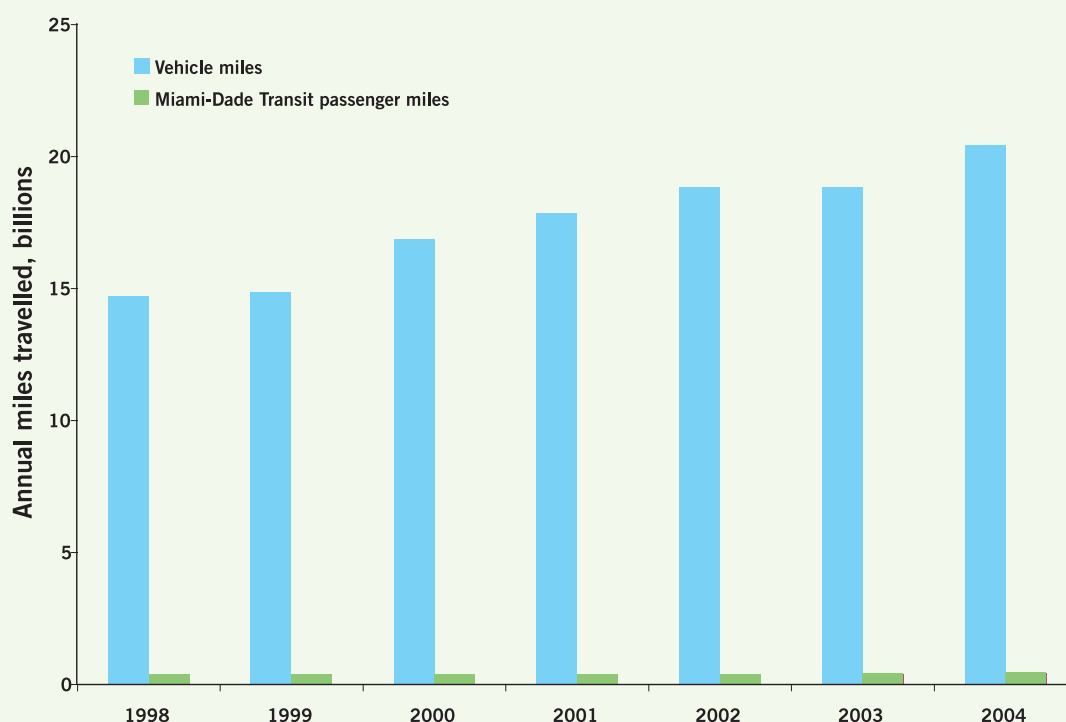


**Figure 3.5:** Cumulative square footage of buildings in the City of Miami over time.

Transportation accounts for 40% of Miami's greenhouse gas emissions and those emissions are likely to increase without action. In Miami-Dade County, vehicle mileage was 14 billion miles in 1997 and reached almost 21 billion miles in 2006. (Figure 3.6) This increasing mileage has taken



its toll on the Miami commute. A recent survey of 10 large cities ranked Miami third in the nation for “commuter pain.”<sup>15</sup> The use of alternative transportation is small relative to automobiles. In recent years, Miami-Dade Transit averaged 0.4 billion passenger miles annually and increased more slowly than vehicle miles traveled. (Figure 3.6)



**Figure 3.6:** Miami Dade County vehicle miles traveled and passenger miles traveled on Miami Dade Transit.<sup>16,17</sup>

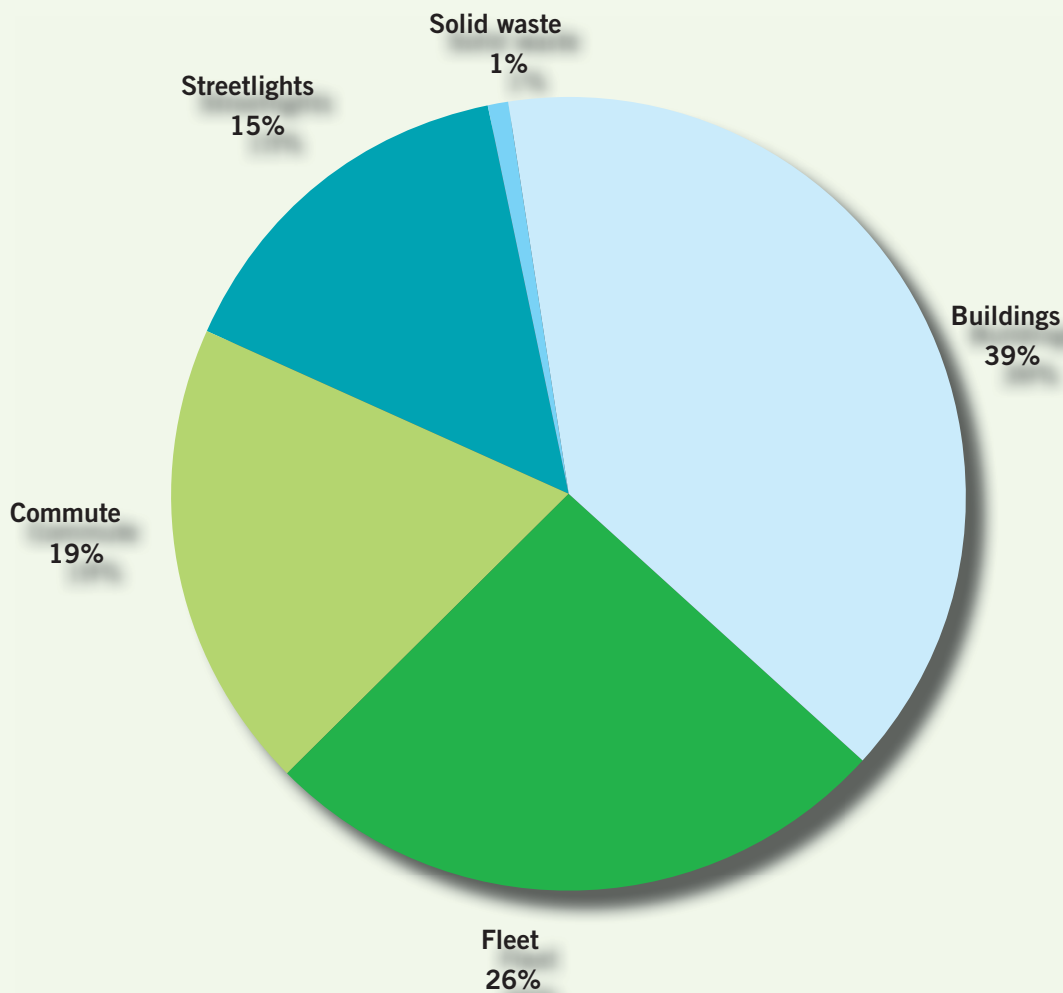
<sup>15</sup> Janet Caldw Institute for Electronic Government, IBM Corporation, (2008). “Feeling the Pain: The Impact of Traffic Congestion on Commuters “ [http://www-03.ibm.com/press/attachments/IBM\\_Traffic\\_Congestion\\_WhitePaper.pdf](http://www-03.ibm.com/press/attachments/IBM_Traffic_Congestion_WhitePaper.pdf).

<sup>16</sup> State of Florida. Department of Transportation Planning Office, Public Road Mileage Reports. <http://www.dot.state.fl.us/planning/statistics/mileagereports/default.htm>.

<sup>17</sup> American Public Transportation Association, Public Transportation Ridership Statistics. <http://www.apta.com/research/stats/ridership/>. Note no mass transit ridership data was available for the year 2000. A value was extrapolated using available data.

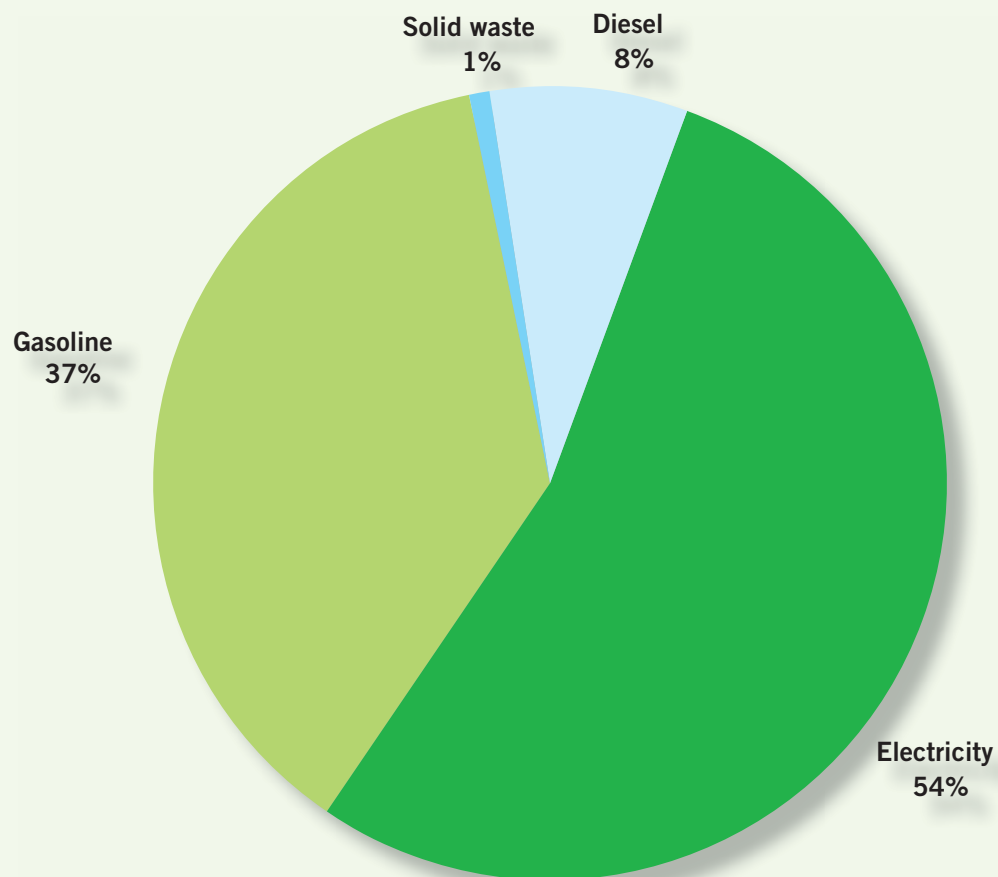
### 3.3 Government Emissions

Greenhouse gas emissions from City of Miami government operations totaled 82,414 metric tons of CO<sub>2e</sub> in the year 2007, which is approximately 1.7% of the City's total emissions. Figure 3.7 presents the distribution of greenhouse gas emissions from City government by sector. Buildings account for 39% of the City government's CO<sub>2e</sub> emissions. The City's fleet represents 26% of the City's emissions and the employee commute is estimated to contribute 19% of the city's emissions. Electricity used to power streetlights represented 15% of the emissions and solid waste contributed 1%.



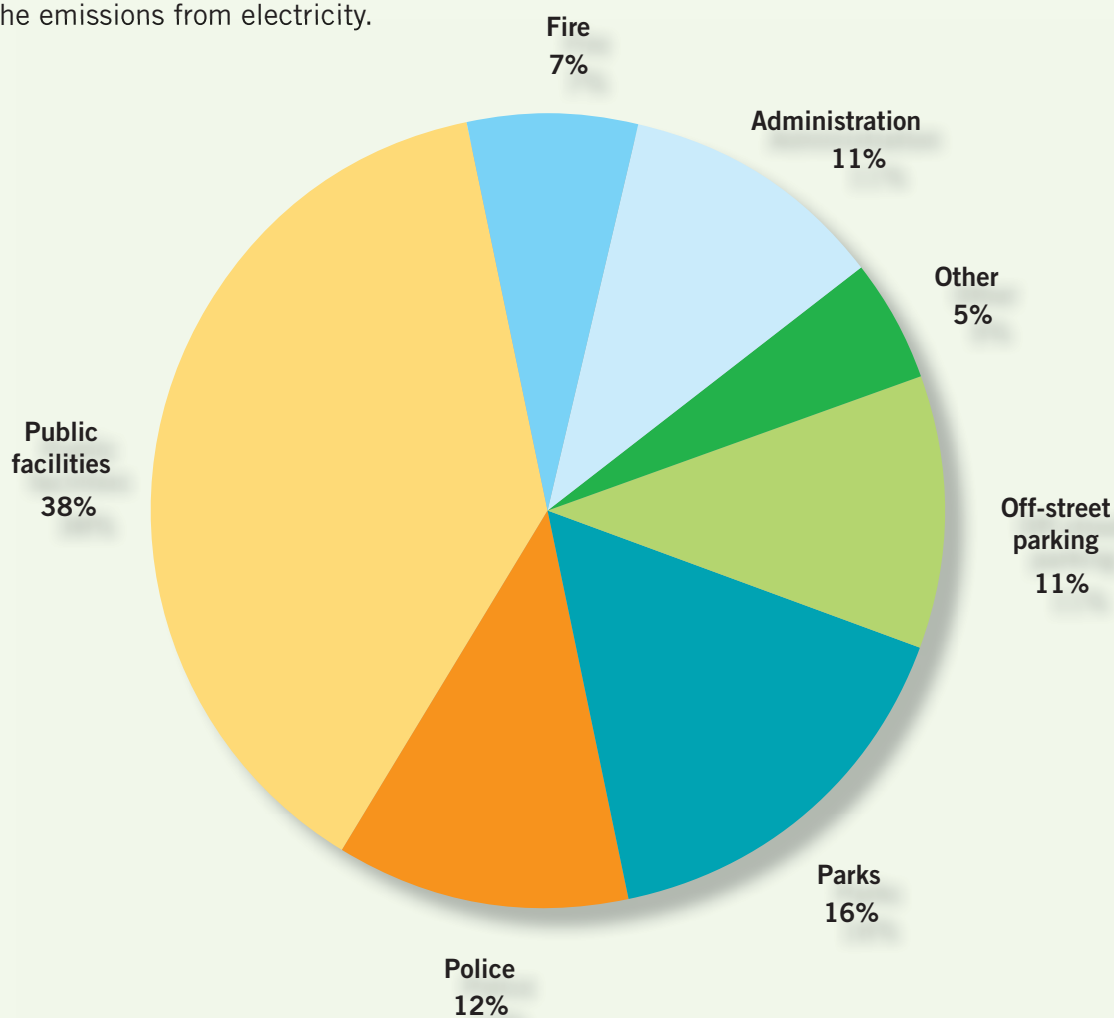
**Figure 3.7:** 2007 Miami government greenhouse gas emissions by sector.

Figure 3.8 presents the City government greenhouse gas emissions by source. Electricity comprises 54% of City government's greenhouse gas emissions. Transportation fuels represent 45% of the City's greenhouse gas emissions. Solid waste comprises 1%.



**Figure 3.8:** 2007 Miami government greenhouse gas emissions by source.

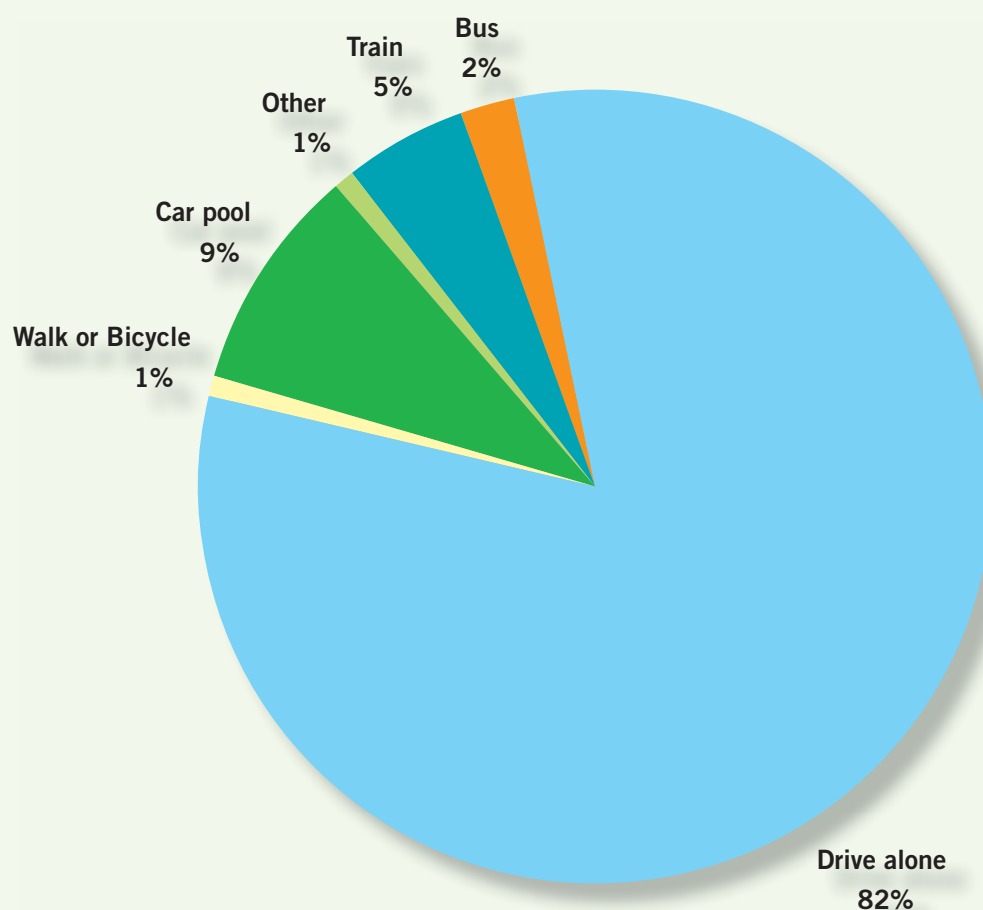
Like buildings citywide, government buildings consume almost exclusively electricity. The distribution of consumption among City government departments is shown in Figure 3.9. The largest fraction is consumed by the City's Public Facilities (38%), Parks (16%) and Off-Street Parking facilities (11%). This group of the City's publicly used properties totals 65% of the City's emissions from buildings. The Police and Fire departments combined account for 19% of the City's emissions from electricity. The City's own administration buildings are responsible for 11% of the emissions from electricity.



**Figure 3.9:** Distribution of greenhouse gas emissions from building electricity consumption by government department.

In 2006, the City government used over 600,000 gallons of diesel fuel and almost 1,600,000 gallons of gasoline. Over three-quarters of the gasoline was consumed by the Police Department. Almost all of the diesel fuel was used by the Fire and Solid Waste Departments.

Employee commutes generated almost as much greenhouse gas emissions as the City government fleet. A survey was conducted of City of Miami employees to determine how they travel to work. Of the almost 500 respondents, 82% drive alone, 9% car pool, 7% take mass transit, and 1% walk or bicycle. (Figure 3.10) Nationally, only 75% of Americans drive alone and 12% car pool.<sup>18</sup> This reflects the car dependence of Miami.



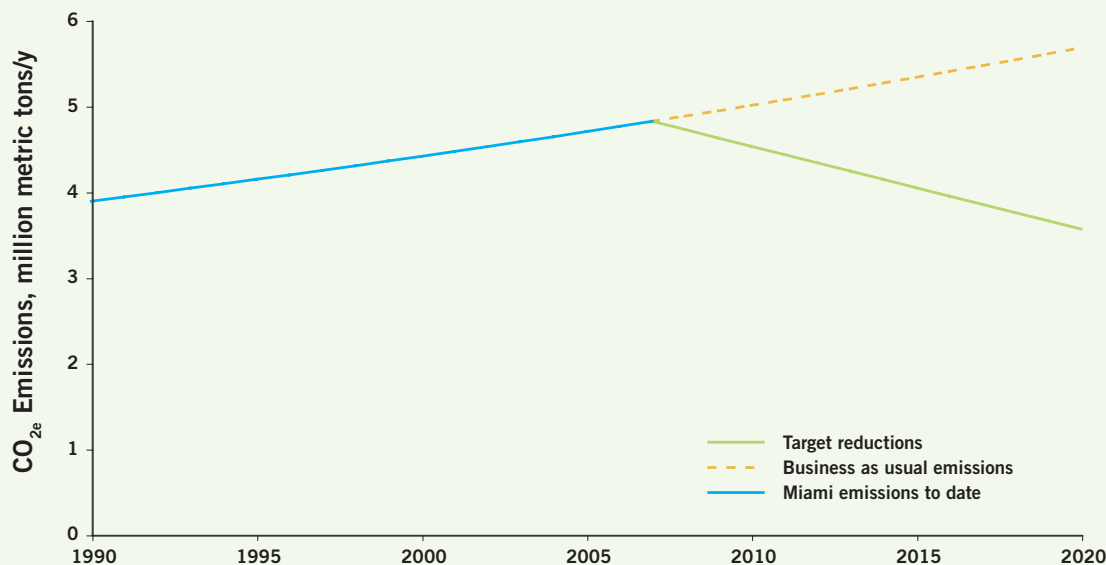
**Figure 3.10:** Primary means of commuting for City of Miami government employees.

<sup>18</sup> Transportation Research Board of the Americas, (2006), "Commuting in American III: The Third National Report on Commuting Patterns and Trends". <http://onlinepubs.trb.org/onlinepubs/nchrp/CIAIII.pdf>.

## 4.0 Reduction Targets

Data for the City of Miami's past greenhouse gas emissions was not directly available. However, an estimate of City growth was derived from review of current and past inventories for the State of Florida and Miami-Dade County. In recent years, the County population increased by an annual rate of 1.4% and per capita greenhouse gas emissions increased by an annual rate of 0.5%, while the population of the City of Miami increased at a rate of 0.8% per year.<sup>19,20</sup> The growth of City of Miami CO<sub>2e</sub> emissions were estimated by combining the City's population growth rate with the County's per capita greenhouse gas emissions growth rate. Based on these projections, under a business-as-usual scenario, the City's greenhouse gas emissions would increase from 4.8 to 5.7 million metric tons per year by 2020.

Based on this analysis, on the feasibility of likely reductions, and on the risks of climate change, the City of Miami has selected a target of reducing its greenhouse gas emissions 25% below 2006 levels by the year 2020, to 3.6 million metric tons, as shown in Figure 4.1. To provide leadership and demonstrate the feasibility of its goals, the City will set target reductions of its government emissions by 25% below 2007 levels by 2015.



**Figure 4.1:** Projected greenhouse gas emissions and target reductions for the City of Miami.

<sup>19</sup> Miami-Dade County, (2006), "A long term CO<sub>2</sub> Reduction Plan for Miami-Dade County, Florida". [http://www.miamidade.gov/derm/climate\\_change\\_urban\\_CO2\\_reduction\\_plan.asp](http://www.miamidade.gov/derm/climate_change_urban_CO2_reduction_plan.asp).

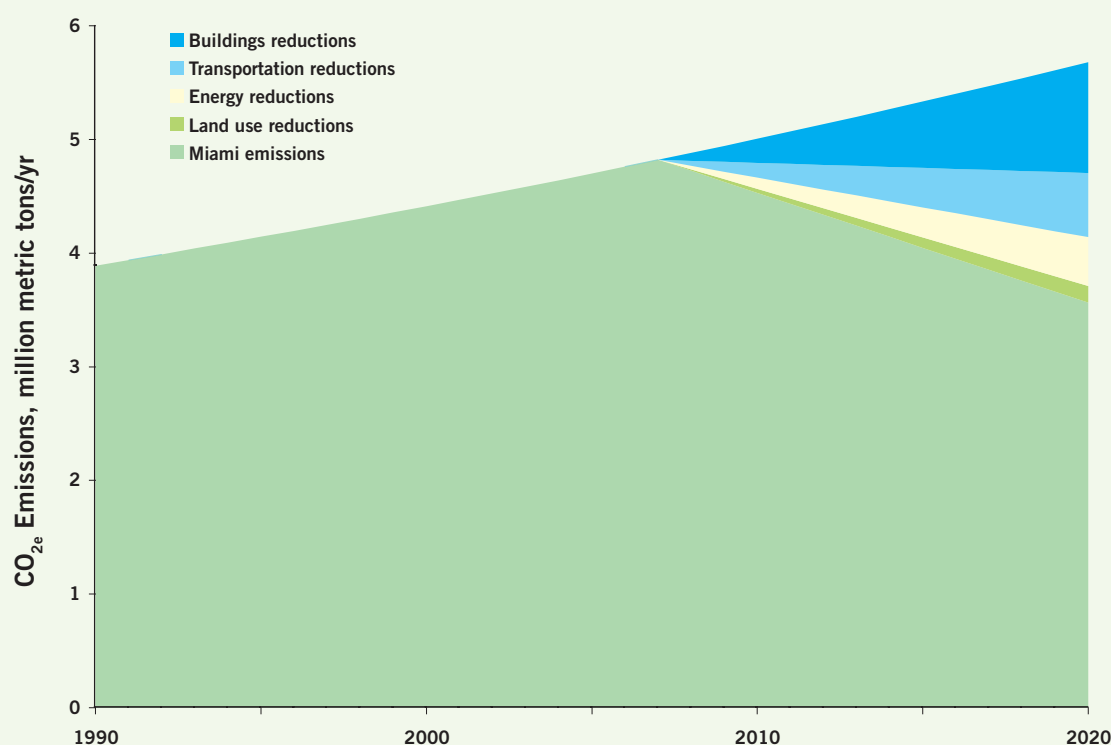
<sup>20</sup> Governor's Action Team on Energy and Climate Change, 2007. Phase 1 Report: Florida's Energy and Climate Change Action Plan Pursuant to Executive Order 07 128. [http://www.dep.state.fl.us/climatechange/files/20071101\\_final\\_report.pdf](http://www.dep.state.fl.us/climatechange/files/20071101_final_report.pdf).



## 5.0 Recommendations

### 5.1 General Recommendations

The City of Miami's goal of reducing its greenhouse gas emissions by 25% by the year 2020 will require widespread efforts across all sectors of the economy, including substantial reductions within the building, energy, transportation, and land use sectors. Estimates of reductions were assigned to each sector based on potential reduction opportunities. There is no single action or regulation that will achieve the targeted reductions, although the most important efforts will focus on the buildings, energy, and transportation sectors which comprise over 90% of the City's total greenhouse gas emissions. Figure 6.1 shows target greenhouse gas reduction citywide and for different sectors.



**Figure 5.1:** Target reductions in greenhouse gas emissions for the City of Miami from the buildings, transportation, energy, and land use sectors. If no reductions are achieved, emissions levels will increase to a business as usual level of 5.7 million metric tons of CO<sub>2e</sub> by 2020. However, if all the targeted reductions are achieved in all sectors, then emissions will drop to 3.6 million metric tons CO<sub>2e</sub> by 2020, which is the City's goal of 25% of 2006 levels by 2020.

As described in further detail in the sections that follow, the City will reduce greenhouse gas emissions citywide by 25% by the year 2020 by addressing four primary sectors:

- **Buildings:** Buildings are responsible for over 50% of the citywide greenhouse gas emissions. The City will reduce 975,000 metric tons of CO<sub>2e</sub> by 2020 primarily through improvements in building energy efficiency.
- **Energy:** Electricity from a single utility (Florida Power & Light (FPL)) supplies almost all of Miami's non-transportation energy. The City will reduce 429,000 metric tons of greenhouse gas emissions primarily by increasing the use of renewable and cleaner energy sources and the use of more efficient, local sources of power.
- **Transportation:** The transportation sector produces 40% of the City's greenhouse gas emissions. The City will reduce 565,000 metric tons of greenhouse gas emissions by 2020 by reducing vehicle miles traveled, increasing fuel efficiency, increasing the use of alternatively fueled vehicles, and increasing the availability and use of alternative transit options, such as bicycle lanes and mass transit.
- **Land Use:** Land use contributes to energy uses in both the building and transportation sectors. The City will reduce 148,000 metric tons of greenhouse gas emissions by absorbing new residents in accordance with Smart Growth land planning principles. Such planning would create walkable cities with alternative transportation modes and efficient land-use zoning regulations that create nodes of intensity and have lower uses of automobiles.

To meet the targets set in the plan, many of the recommendations below will require cooperation of the City with its residents, with other governments and agencies, with utilities, and with the private sector. The City cannot accomplish these tasks alone. A successful Climate Action Plan and also a successful effort to limit greenhouse gas emissions require cooperation across many borders.

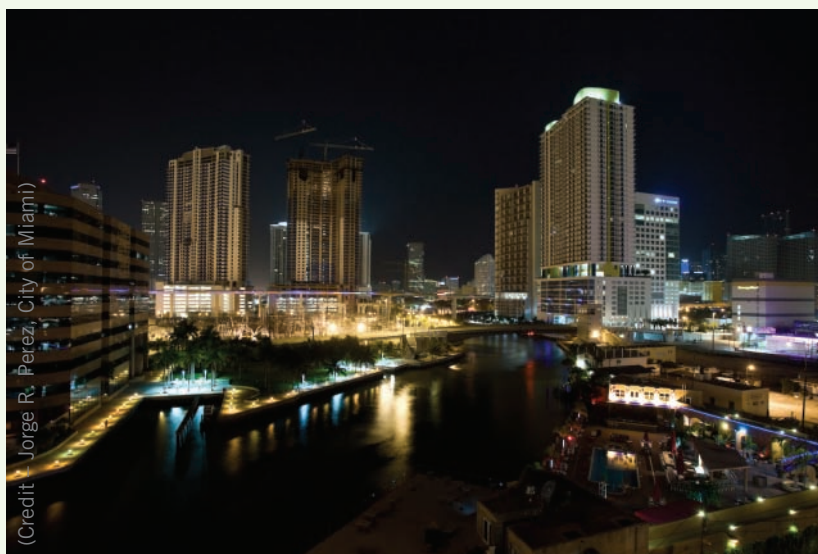
The scope of this climate action plan is limited to actions which will most significantly mitigate emissions of greenhouse gas from the City of Miami. Because of this scope, MiPlan plan does not address, or mentions only briefly, many other related environmental issues such as tree planting, water conservation, waste reduction, and recycling, among others, which are all still strongly supported by the City.

## 5.2 Specific Recommendations

This section outlines recommended actions for reducing greenhouse gas emissions within the City of Miami. By the middle of 2009, Phase II of the Climate Action Plan will develop specific cost estimates, an investment/financing plan, and specific implementation plans for recommended actions. However, the most significant initiatives will be started shortly after completion of MiPlan. Some actions are already being implemented while others may change in response to new circumstances. **It is recommended that efforts in years 1 through 5 focus primarily on Initiative 1: Increase energy efficiency in buildings.**

### Initiative 1: Increase energy efficiency in buildings

Buildings in the City of Miami total over 280 million square feet, have an assessed value greater than \$53 billion, and consume over 5 million MWh of electricity per year. The building sector represents almost 50% of Miami's greenhouse gas emissions and almost all building energy comes from electricity, unlike most other cities which have significant quantity of heating supplied by natural gas and heating oil. Future reductions in greenhouse gas emissions must address energy efficiency in new and existing buildings.



**Photograph 5.1:** Miami buildings at night

The energy efficiency of current buildings can be increased dramatically simply by improving the operation of existing systems. The US EPA estimates that 30% of energy in US buildings is used inefficiently or unnecessarily, such as for the lighting or cooling of unoccupied spaces.

Simple improvements, which can be implemented by homeowners or property managers, may include occupancy sensors or programmable thermostats. Increasing air conditioning set points by 1 degree Fahrenheit are estimated to decrease energy consumption by 3%.

For larger or more complex buildings, a professional commissioning study can fully assess the operational performance of buildings. Commissioning refers to the process of verifying that a building is operating as designed. If a building is not operating as designed, significant amounts of energy can be wasted, due to improper set points, disabled control systems, or poorly installed equipment. The proper sizing and installation of residential HVAC systems, as another example, can greatly reduce unnecessary energy use. Studies have shown that commissioning of operations and maintenance can reduce building energy consumption 5 – 20% with a payback in less than 2 years.<sup>21</sup>

In addition, substantial reductions of greenhouse gas emissions can be achieved by retrofits, which replace older, inefficient equipment with newer more efficient models. Energy retrofits often address motors, controls, lighting, air handling systems, and insulation, among others. Older equipment can be replaced by newer, more efficient equipment, often at a net negative cost, when energy savings are included. Eighty percent of the City's building stock is more than 20 years old and thus ripe for energy improvements. Some mechanisms for energy efficiency, such as performance contracting, provide guarantees that the cost of a project will not be more than the resulting energy savings. Retrofits of air conditioning and refrigeration equipment should also ensure that refrigerants, which are powerful greenhouse gases, causing many times more harm than the same amount of emitted CO<sub>2</sub>, are reclaimed and recycled in accordance with US EPA rules.

### **Action 1-1: Form an alliance to address energy efficiency in buildings.**

The City will form an alliance with other government and non-profit organizations, including universities, schools, and hospitals, to aggregate resources for the financing, implementation, and purchasing of services related to increasing energy efficiency in South Florida buildings. In the City of Miami, over 33 million built square feet, or almost 12% of all buildings, belong to government or non-profit groups.

#### **Specific actions:**

- Create alliance of local building owners in government and non-profit sector to address energy efficiency in buildings by February 2009.
- Identify and implement strategies for the financing and performance of energy

<sup>21</sup> Mills, Friedman, Powell, Bourassa, Claridge, Haas, Plette, (2004), "The Cost-Effectiveness of Commercial-Buildings Commissioning: A Meta-Analysis of Energy and Non-Energy Impacts in Existing Buildings and New Construction in the United States" Lawrence Berkeley National Laboratory. <http://eetd.lbl.gov/Emills/PUBS/PDF/Cx-Costs-Benefits.pdf> .

efficiency and renewable energy upgrades in South Florida buildings.

- Use this alliance for increased purchasing power of energy efficiency related financing, services and products.

### **Action 1-2: Reduce energy consumption in existing government buildings.**

The City will develop a program to substantially decrease energy consumption in its own government buildings. The City government currently spends over \$10 million per year on electricity costs with a substantial electricity rate increase likely in the next few months. The program will seek to address energy efficiency in all City government buildings and those of its partners, using tools such as commissioning, energy audits, and retrofits to increase efficiency in the City government's building stock.

#### **Specific actions:**

- Maintain inventory of all government buildings in an energy portfolio tool, such as Energy Star Portfolio manager.
- Perform commissioning and energy audits of all large city government buildings.
- Perform retrofits of inefficient equipment identified during energy audits, using performance contracting or other appropriate mechanisms.
- Require the City to follow best industry practices in all energy upgrades, including the US EPA Energy Star Quality Installation Program to ensure proper equipment sizing and selection, refrigerant charge, air flow and minimal duct leakage.
- Retrofit all City owned outdoor lighting to high efficiency lighting technologies based on feasibility and life-cycle analysis. High efficiency light options to be considered may include: Light emitting diodes (LEDs,) induction lighting, and solar powered lights.
- Require any energy service companies (ESCOs) seeking to do business with the City that include guaranteed energy performance savings contracts to achieve a minimum of 25% in efficiency savings. Contract preferences should be given to ESCOs that utilize distributed generation, co-generation and renewable energy systems as outlined in Initiative 2.
- Lobby the Florida Public Service Commission and FPL to adopt more energy efficient technologies for street lighting and other applications.
- Require purchasing of Energy Star rated equipment in City operations.

### **Action 1-3: Reduce energy consumption in existing private buildings.**

Based on the City's efforts to increase efficiency in existing government buildings, the City will develop a program to address energy efficiency in the City's private building stock. Despite recent building booms, over 80% of the City's building stock is greater than 20 years old. The program will apply the same tools as used for government buildings to the private building stock: commissioning, energy audits, and quality equipment retrofits.

#### **Specific actions:**

- Develop citywide energy upgrade program which addresses financing and mechanisms to allow performance of energy audits, commissioning, performance contracting, and other energy efficiency and renewable energy upgrades in citywide buildings. This program should mandate energy improvements during major renovations and/or a point of sale and should require that all energy upgrades follow industry best practices such as the US EPA Energy Star Quality Installation.
- Develop financial incentives for energy efficiency improvements and disincentives for energy inefficiency. Mechanisms for these incentives and disincentives may include permitting fees and property taxes. A measure of efficiency, such as kilowatt hours per square foot, should be selected to determine inefficiency.
- Require a certificate certifying compliance with the refrigerant reclamation and recycling requirements of Section 608 of the Clean Air Act of 1990 and associated US EPA regulations for all HVAC system replacement projects performed in citywide buildings and for all commercial refrigeration replacement projects performed in citywide grocery stores and restaurants.
- Work with local utilities, retailers, and contractors to promote energy efficiency efforts and ensure best practices are utilized .
- Develop policy for minimum efficiency standards in affordable housing program.
- Develop a program to encourage energy conservation in the homes of part-time residents while their units are vacant.
- Incorporate strategic tree planting for energy efficiency into the Green Miami tree planting campaign.

### **Action 1-4: Reduce energy consumption in all new construction.**

Over the last 10 years, the City has added 36 million square feet of new construction. Implementation of green building strategies is cheapest at the time of construction. The City will require that both government and citywide new construction are built to green building standards.



**Specific actions:**

- Develop mandates and incentives for green buildings.
  - All buildings over 50,000 square feet should meet Leadership in Energy and Environmental Design (LEED) silver requirements.
  - Provide density bonuses and expedited permitting for green buildings.
- Require all City government buildings over 5,000 square feet to be built to a minimum LEED silver certification.
- Promote improvement of energy codes and energy efficiency of new construction, such as the “30% Solution” proposed by the Energy Efficient Codes Coalition and the “2030 Challenge” by American Institute of Architects.

**Action 1-5: Reduce the heat island effect.**

Urban areas are known to have temperatures elevated by as much as 10 degrees Fahrenheit relative to rural areas. This is referred to as the heat island effect. The primary causes of the heat island effect are removal of trees and vegetation, trapping of air by buildings and narrow streets, and waste heat from buildings and vehicles. Strategies to reduce the impact of the heat island include increasing shade by tree cover and/or increasing the reflectiveness of materials in the built environment. In urban areas, the US EPA estimates that 3-8% of energy consumption is due to the heat island effect. Strategic tree planting can reduce energy consumptions by up to 25% in some buildings. Addressing the heat island effect can have the dual benefits of reducing the City’s cooling load and increasing carbon sequestration through tree planting.

**Specific actions:**

- Require roofs on new construction to be designed to mitigate the heat island effect through high solar reflectiveness, green roofs or other means.
- Provide incentives for existing buildings to increase the solar reflectiveness of their roofs or to convert to green roofs.
- Implement the City’s Tree Master Plan to increase the City’s tree canopy to 30% by 2012 and to ensure that trees are planted in a manner which promotes tree survival and benefit to the environment. Currently, the tree canopy is as low as 10% in some areas and the City is determining the amount of trees needed to bring the canopy to 30% coverage.
- Hire an Urban Forester to promote tree plantings and build the city’s tree infrastructure.

- Require the reduction of paved surfaces and where paved surfaces cannot be avoided require pervious and/or highly reflective paving. Where the city does not directly control paved surfaces, the City should encourage other authorities to utilize cool pavement technologies.
- Promote the construction of carport canopies to be used for shading and distributed renewable energy generation.

### **Action 1-6: Educate the business sector and the public on energy efficiency in homes and businesses.**

Efforts at increasing energy efficiency in the City's buildings must be coupled with culturally competent educational efforts dedicated to improving acceptance of energy efficiency efforts and to making the community aware of the resources available for energy efficiency improvements. Efforts should address the barriers to energy efficiency and promote behavior change through social marketing techniques.

#### **Specific actions:**

- Develop green building lab, "Miami Green Lab", as a resource and demonstration site for commercial, government, and residential communities.
- Develop educational programs on energy efficiency, distributed generation, and renewable energy systems in buildings for homeowners, businesses, government staff, and those in the building industries, partnering with the US Green Building Council, Florida Green Building Coalition, BOMA, FPL and other relevant organizations.
- Encourage maximum participation by residents and business owners in the City's energy efficiency programs through marketing and education.
- Educate government purchasing agents in each City department regarding the benefits of Energy Star rated equipment, including the cost savings to the city.
- Encourage community input on strategies for improving energy efficiency in buildings

**Action 1-7: Review progress on increasing energy efficiency in buildings.** The City will review its energy efficiency progress annually.

#### **Progress indicators**

- Consumption of energy by City government buildings.
- Consumption of energy by citywide buildings.

## Initiative 2: Reduce greenhouse gas emissions from energy generation

Significant long-term reductions in greenhouse gas emissions will also require substantial changes in the sources of the City's energy. For instance, FPL reduced their CO<sub>2</sub> emissions per KWh by over 10% between 2003 and 2006 by changing their energy mix. In those years, they have halved their use of oil and increased their use of more efficient natural gas by over 40%. To meet MiPlan reduction goals, the City will need to develop distributed power and cogeneration, and substantially increase the use of renewable energy sources such as solar or wind power, as well as more efficient fossil fuel sources, such as natural gas.

### Action 2-1. Increase the use of distributed generation and cogeneration.

Distributed local power can offer several benefits, including greater efficiency and greater reliability because the impact of a system failure is smaller in scale than with a centralized power system. Cogeneration can offer substantially greater efficiency by reclaiming waste heat from electricity generation to generate cooling.

#### Specific actions:

- Identify barriers to cogeneration and lobby the state to remove barriers.
- Develop or provide incentives for distributed cogeneration projects in the City.
- Encourage expansion of natural gas service areas to facilitate additional distributed generation.
- Identify and encourage multi-building district heating and cooling systems.
- Encourage co-generation projects in the City that utilize emissions-free power generation.

### Action 2-2. Increase the use of renewable energy sources.

The most significant reductions in greenhouse gas emissions can be obtained by switching to renewable energy sources, such as solar, wind power, geothermal, methane extraction, and hydropower both at the retail and wholesale level. Solar, wind power, geothermal and hydropower offer the benefit of zero emissions energy. The City will monitor the increasingly competitive costs of renewable energy technologies that are available relative to conventional energy technologies. Because of their future importance in reducing greenhouse gas emissions, it is imperative that the City take steps to foster the future development of renewable energy. This should be done by both encouraging local sources of alternative energy and by encouraging utilities to increase their use of renewable energies.

Solar energy is one of the most promising renewable energy technologies, particularly for South Florida. In South Florida, solar water heating is currently the most economically feasible of renewable energy technologies. With current state and federal incentives, solar water heating has a payback period of 3 to 5 years. South Florida also has great potential for generating electricity from solar photovoltaic (PV) cells. The Florida Solar Energy Center has found that Florida has better potential than most of the nation for use of PV.<sup>22</sup> Currently, state rebates and federal tax incentives are available for PV. As technologies evolve, more renewable energy sources will become feasible in South Florida. Currently, the use of wind, geothermal, and biomass to energy are gaining ground in some areas and the City has an opportunity to capitalize on the growth of these green industries.

**Specific actions:**

- The City should develop a policy to foster the growth and remove barriers for all renewable energy development within the City.
- Support all appropriate changes to the Florida Building Code that are both safe and contribute to the development of renewable energy.
- Implement the use of solar hot water heating within City government facilities by replacing existing hot water systems.
- Promote the installation of distributed, renewable energy systems for citywide homes and businesses through the City's energy efficiency programs.
- Encourage local adoption of solar systems through additional tax incentives and/or rebates.
- Explore facilitation of bulk purchases of solar equipment for businesses.
- Develop additional on-site generation projects at City facilities and other locations in the alliances formed in Action 1-1.
- Encourage companies engaged in the manufacture of PV systems and other renewable energy industries to open offices in the Miami area.

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<sup>22</sup> Florida Solar Energy Center, (2007), "Does the "Sunshine" State have a sufficient solar resource to support solar energy applications?" [http://www.fsec.ucf.edu/en/media/enews/2007/2007-04\\_Sunshine\\_state.htm](http://www.fsec.ucf.edu/en/media/enews/2007/2007-04_Sunshine_state.htm).

### **Action 2-3: Encourage utilities to further decrease greenhouse gas emissions.**

FPL has reduced its emissions per unit of energy generated by over 10% between 2003 and 2006 as shown in Figure 3.4. This is promising but further reductions are needed.

#### **Specific actions:**

- Lobby local utilities and the Florida Public Service Commission to increase the use of renewable and less carbon intensive energy sources within the State of Florida and to change rate structures to further allow utilities to profit from efficiency rather than consumption.

### **Action 2-4: Education on alternative energy.**

The residential and business community needs more information about renewable energy sources, their availability, costs, and financial incentives.

#### **Specific actions:**

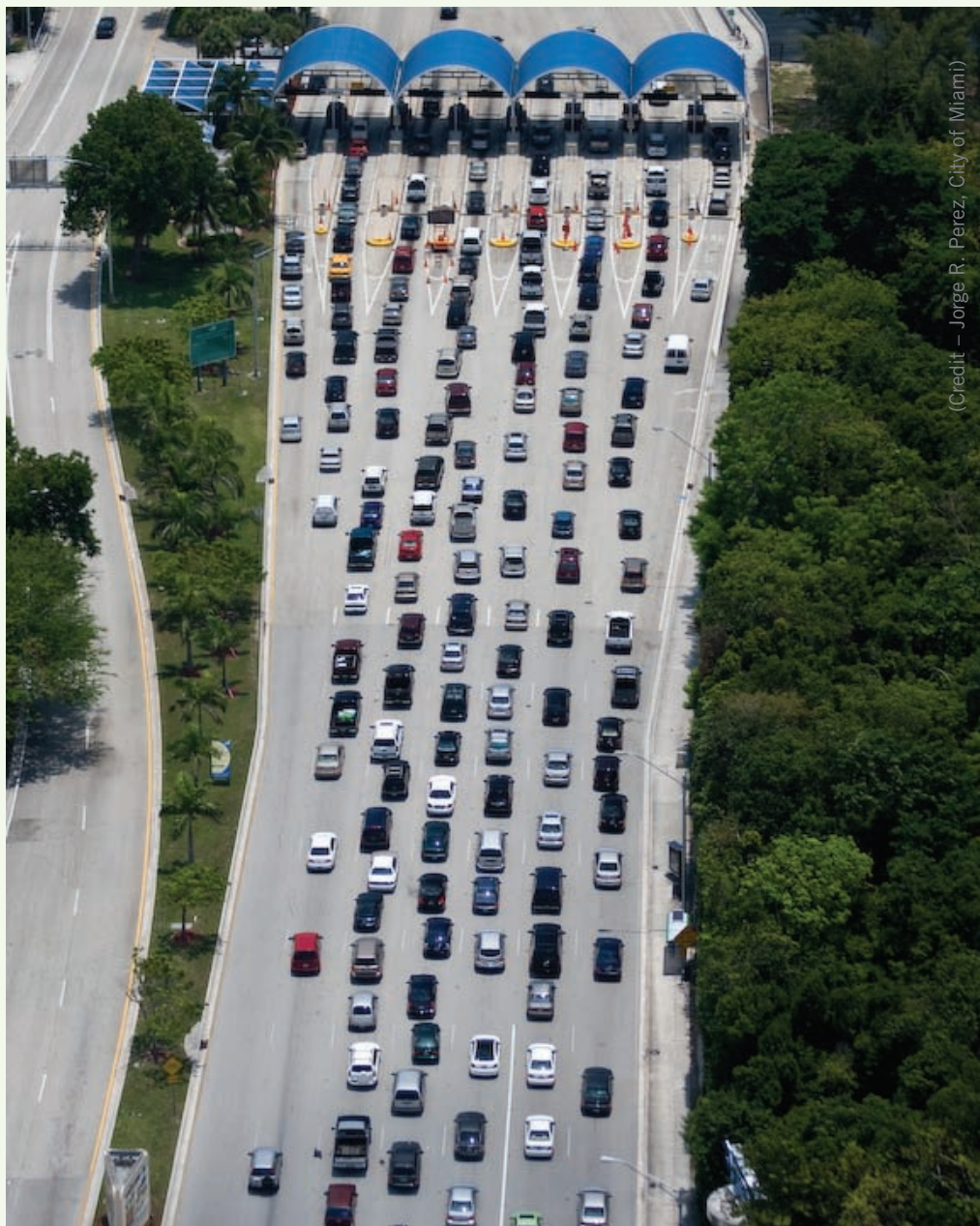
- Develop targeted campaign to remove the barriers to solar use and promote current and future tax incentives and rebates.
- Promote the benefits of solar water heating and other renewable energy sources through a targeted media campaign, including increasing awareness of the state net-metering laws.
- Encourage community input on strategies to utilize renewable energy in Miami.

### **Action 2-5: Review progress on reduction of greenhouse gas emissions from energy generation.**

Annually, the City will review its progress in this area, by evaluating the following parameters.

#### **Progress indicators**

- Reduction in City's greenhouse gas emissions per unit of energy produced.



(Credit – Jorge R. Perez, City of Miami)

**Photograph 5.2:** Traffic approaching Rickenbacker Causeway Tollbooth.

### Initiative 3: Reduce emissions from transportation

Transportation accounts for approximately 40% of the City's greenhouse gas emissions. Greenhouse gas emissions from transportation will be accomplished primarily through three strategies: (1) reducing vehicle miles traveled by encouraging alternative transportation and reducing worker commutes; (2) increasing fuel efficiency of vehicles; and (3) switching to less carbon intensive fuel sources.

#### Action 3-1: Facilitate and encourage alternative means of transportation.

The City should facilitate and encourage the use of public transportation, walking, carpooling, and bicycling. The City should develop a program that supports these means of transportation and removes barriers to their adoption for its own employees, City residents, and for local businesses.

##### Specific actions:

- The City should work with Miami-Dade County and State of Florida to increase funding for mass transit.
- Develop and implement Bicycle Action Plan, which will include increases in the total bicycle lane miles within the city.
- Create parking demand strategies which encourage the use of efficient vehicles, carpools, and alternative transportation. This plan should address City government facilities, on street parking, and commercial parking.
- Work with the county and state plans to create a road pricing plan which encourages the use of efficient and alternative transportation.
- Lobby the county, state, and federal governments to increase funding for mass transportation and to make funding for public transportation a budgetary priority.
- Provide and encourage local shuttles, jitneys, trolleys, and people mover (where appropriate) to connect public transportation systems.
- Encourage employers and local governments to subsidize mass transit usage and fees.



### **Action 3-2: Increase telecommuting, compressed workweeks and flexible hours.**

Many businesses and governments now offer their employees the opportunity to work from home, to work compressed work weeks, and/or to work flexible hours. These strategies can reduce and eliminate trips to the office, reduce traffic congestion, and can be considered a benefit for employees.

#### **Specific actions:**

- The City of Miami should develop a program to offer compressed work weeks, telecommuting, and flexible hours for applicable City government employees.
- The City should promote the use of telecommuting, compressed work weeks, and flexible hours by local businesses.

### **Action 3-3: Encourage higher fuel efficiency in vehicles.**

The automobile will be a significant fixture of modern society for the foreseeable future. Efforts to reduce greenhouse gas emissions from the transportation sector must include increasing the fuel efficiency of automobiles. Current federal standards will increase the fuel economy of new cars to an average of 35 mpg by the year 2020. However, it should be noted that federal fuel economy standards by themselves are unlikely to decrease greenhouse gas emissions below current levels, given current trends of increases in vehicle miles traveled (VMT). Therefore, increases in fuel efficiency must be paired with efforts to reduce VMT and utilize alternative fuels. The City should take steps to encourage the use of fuel-efficient vehicles within the City of Miami, including:

#### **Specific actions**

- Provide preferred parking, reduced parking fees, reduced tolls, and sales tax incentives for fuel-efficient vehicles.
- City government operations should purchase additional fuel-efficient vehicles for its own fleet, increasing the fuel efficiency of new vehicles by 5% each year. Where feasible, the City should purchase alternatively fueled vehicles, such as hybrid, electric and/or biofueled.
- Lobby federal and state governments to further increase fuel efficiency standards for automobiles.
- Develop a policy to require City government vendors and contractors to utilize environmentally friendly vehicle fleets for their City work.



### **Action 3-4: Encourage uses of alternative fuels in transportation.**

For vehicle transportation, there are currently multiple alternative fuel technologies being explored. These include electric cars, plug-in cars, biofuels, and hydrogen fuel cells. All offer the potential for substantial greenhouse gas reductions. Emissions associated with both electric cars and hydrogen fuel cells can approach zero emissions if a wind or solar source is used to charge these vehicles. Biofuels derived from waste products can have substantially lowered emissions relative to conventional fossil fuels. The manufacture of biofuels is constantly evolving. At present, there is some uncertainty about the environmental benefits of biofuels, particularly those derived from food sources grown on land which could otherwise be used for food production, or which use substantial quantities of fossil fuel in their production. However, the use of biofuels derived from waste products such as waste vegetable oil or from cellulosic materials clearly reduces greenhouse gas emissions. These more sustainable means of producing biofuels, which are currently available, have not yet been implemented on a widespread basis.

#### **Specific actions:**

- Provide preferred parking, discounted parking, reduced tolls, access to express lanes, and support reduced sales taxes for plug-in, electric, and fuel cell vehicles.
- Promote the use of sustainably sourced biofuels. Encourage the use of local waste oils as fuels.
- Increase use of sustainably sourced biofuel in City fleet to 20% by 2015.

### **Action 3-5: Education and Outreach.**

The City will provide educational programs in the area of transportation.

#### **Specific actions:**

- Work with partner organizations to promote awareness of commuter programs and benefits.
- Develop educational campaign to promote high fuel efficiency and alternative vehicles.
- Partner with South Florida Commuter Services to promote commuting options to City employees and City businesses.
- Encourage community input on strategies for reducing greenhouse gas emissions from transportation.

### Action 3-6: Progress indicators.

The City will conduct an annual review of its efforts to reduce greenhouse gas emissions from the transportation sector. Items to be reviewed will include:

#### Progress indicators

- City government's annual reduction in fuel consumption.
- Citywide annual reduction in fuel consumption
- Annual increase in the number of bike paths across City.
- Annual reduction in vehicle miles traveled within the City.

### Initiative 4: Land Use.

Greenhouse gas emissions per capita are lowest in cities which have the densest populations and are built around public transportation, such as New York and London. Development should emphasize access to public transportation, walkability, bicycle access, decreased parking, and mixed-use zoning. Over the next 12 years at recent growth rates, the City would absorb another 50,000 residents, representing a 12% increase in the City's population. How the City absorbs these future residents will significantly affect the carbon footprint citywide. The principles of smart growth embodied in Miami 21 include growth by infill and redevelopment, new development focused on nodes of transportation, and access to alternative means of transportation.

### Action 4-1: Adopt land use strategies which encourage Smart Growth.

Miami 21, a rewrite of the City's zoning code, follows the principles of Smart Growth land use which encourages energy efficient transportation by development which lessens dependence on cars.

#### Specific actions:

- The approval of Miami 21 would transform the built environment to support Smart Growth and energy-efficient living. Specifically, Miami 21 would:
  - Coordinate land use and zoning to encourage Smart Growth techniques to facilitate living, working, and conducting daily service activities within a ¼ mile of most residents.
  - Improve the built environment through redevelopment creating pedestrian-friendly shaded sidewalks.

## Initiative 5: Adaptation planning.

Based on current scientific predictions that a rise in sea level is inevitable in the next century and because of Miami's low elevation, even a small sea level rise will have an impact on the City, including the flooding of some areas and saltwater intrusion on the drinking water supply. It is imperative that City government begin to consider the impact of climate change in future planning and land use decisions.

### Action 5-1: Begin process of planning for climate change impacts.

#### Specific actions:

- Incorporate climate change into long-term planning, including the likely impacts of sea level rise on current and future infrastructure, flood mitigation, water supply risk, and health impacts of increased temperatures.
- Increase water management efforts including water conservation, pollution prevention, and water resource planning.

## 5.3 Implementation

Over the next six months to one year, the City will develop a plan for the implementation of the Climate Action Plan. The plan will address the specifics of implementation including responsible parties, timelines, likely quantity of CO<sub>2e</sub> reductions, financing strategies, costs of implementation, as well as revenues and staffing needs. The City will work closely with other local governments to implement MiPlan, including Miami-Dade County, which has a long history of working on climate change issues, and the State of Florida, which has established a strong climate change initiative.

## 5.4 Monitoring

Annually, the City will review its greenhouse gas emissions and the reductions achieved by its actions. Where reductions appear to be falling short of goals, the City will review its action plan and make revisions where appropriate to improve attainment of reduction goals. The results of this monitoring will be compiled in an annual written report which should be included among the City's annual goals.

## APPENDIX A - Acknowledgements

This plan was prepared by the collaboration with many members of the City government and the community over a very short period of time. We would like to thank them all for their assistance and apologize to any whose names were omitted.



**Photograph A.1:** Meeting of Green Commission MiPlan Subcommittee

Mayor Manuel A. Diaz  
 Commissioner Angel Gonzalez  
 Commissioner Tomas P. Regalado  
 Commissioner Joe M. Sanchez,  
*Chair of the Green Commission*  
 Commissioner Marc Sarnoff,  
*Chair of the MiPlan Committee*  
 Commissioner Michelle Spence-Jones  
 City Manager Pedro G. Hernandez

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### Office of the Mayor

Suzanna Valdez  
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### Office of Commissioner Sarnoff

Ron Nelson

### Green Commission MiPlan Subcommittee

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 Stephen Chang  
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 Jose Fuentes  
 Paul Johnston  
 Maxine Lopez  
 David Marko  
 Carolyn Mitchell  
 Bill Traurig  
 Henry Pedroso  
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 Paul Savage  
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 Ed Blanco  
 Michael Boudreaux  
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 Vanessa Castillo  
 Laura Cherney  
 Reginald Duren  
 Elyrosa Estevez  
 Thelma Free  
 Perla Gonzalez  
 Sergio Guadix  
 Regina Hagger  
 Roger Hernstadt  
 Charlene Jacks-Palomino  
 Marcus James  
 Rodolfo Llanes  
 Lissette Lopez  
 Donald Lutton  
 Steven Margolis  
 Judy Marsie-Hazen  
 Julia Martin  
 Alex Martinez  
 Anna Medina  
 Lilia Medina  
 Chris Morales  
 Victor Morales  
 Keith Ng  
 Dorcas Perez  
 Jorge R. Perez  
 Haydee Regueyra  
 Gisela Rodriguez  
 Donna Shelley  
 Kym Smith  
 Larry Spring  
 Vontilla Steven  
 Katerina Tsaknaki  
 Madeline Valdes  
 Andrew Vera  
 Liza Walton  
 Diane Waters  
 Penny White

## APPENDIX B – Background Information on Climate Change

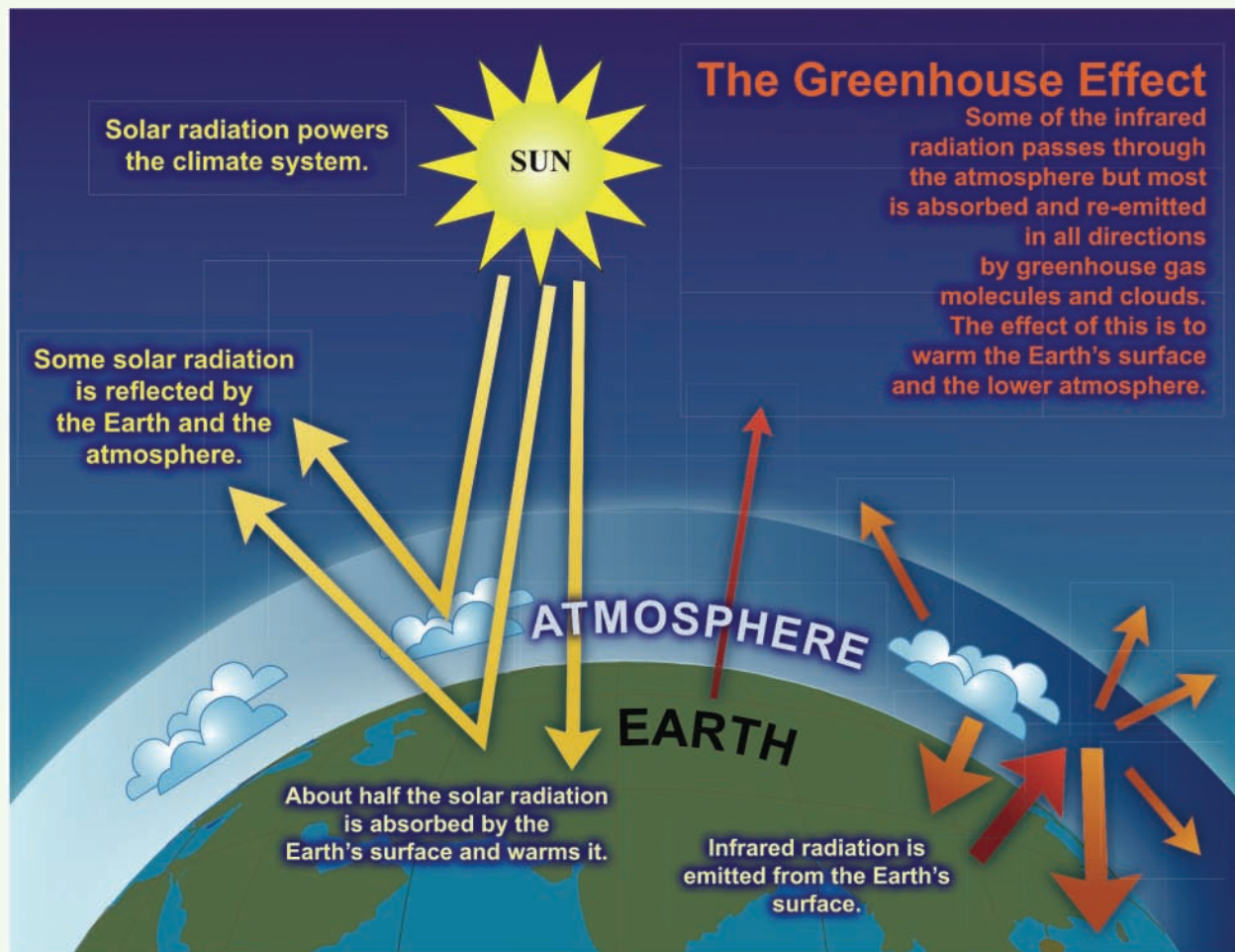
According to the US EPA, climate change refers to measurable changes in the earth's climate (such as temperature, wind, or precipitation) which extend over periods of decades or greater.<sup>23</sup> Global warming refers to a specific type of climate change, the increase in temperature of the Earth's atmosphere.<sup>24</sup> Historically, the earth's climate has changed dramatically, from warm periods where the majority of Florida was underwater to the most recent ice age where glaciers covered what are now New York and Chicago. However, these changes occurred gradually and were due to natural causes. Although climate change and global warming can occur from a variety of causes, both natural and manmade, for the purposes of MiPlan, these terms will refer to climate change and global warming due to greenhouse gas emissions associated with human activity.

Today, much of the current climate change can be attributed to human activity and is occurring far more rapidly than in any known era. Greenhouse gases occur naturally in the atmosphere, however, human activity is dramatically increasing their concentration in the atmosphere. Figure B.1 summarizes the greenhouse effect. The term "greenhouse gases" refers to gases in the atmosphere which absorb infrared radiation emitted from the earth. As the amount of greenhouse gases in the atmosphere increases, the fraction of infrared radiation absorbed in the atmosphere increases, which in turn increases the earth's temperature. The increase of global temperature has already started to produce related climate effects such as rising sea levels and melting ice. The greenhouse gas which has the greatest impact on global warming is carbon dioxide (CO<sub>2</sub>) because it is emitted in much greater quantities than any other greenhouse gas. Other significant greenhouse gases include methane, nitrous oxide, and fluorinated gases. Considered as a group, greenhouse gas concentrations are often reported as carbon dioxide equivalents (CO<sub>2e</sub>).

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<sup>23</sup> US EPA, "Climate Change: Basic Information", <http://www.epa.gov/climatechange/basicinfo.html>.

<sup>24</sup> Ibid.



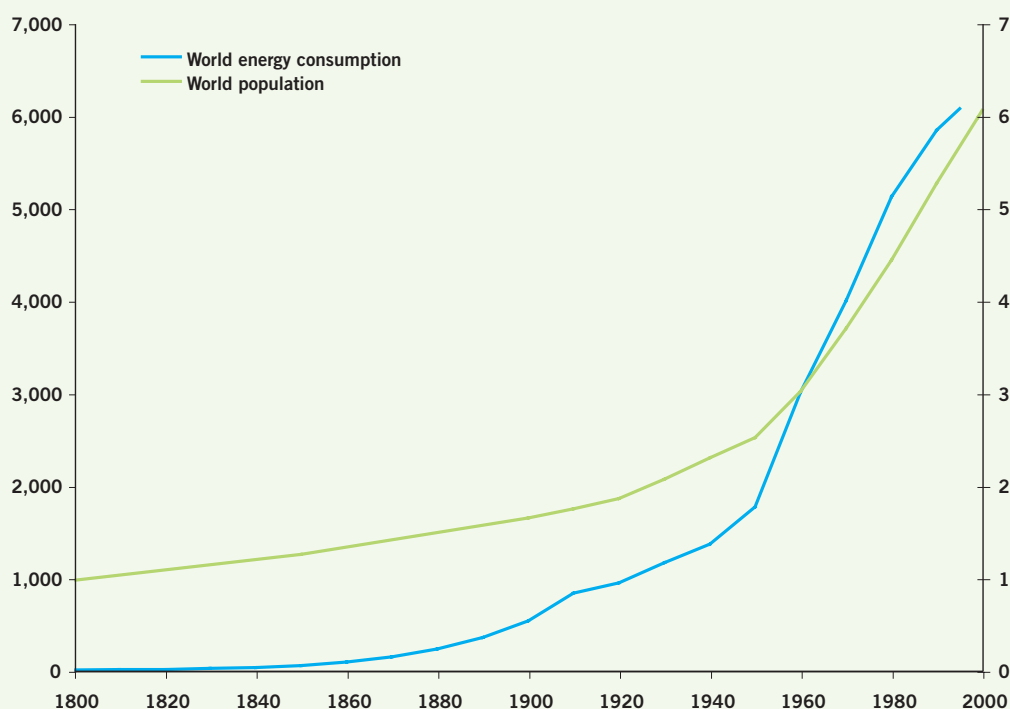
**Figure B.1:** An idealized model of the natural greenhouse effect.  
 (See referenced IPCC 2007 text for explanation.)<sup>25</sup>

Carbon dioxide (the primary greenhouse gas) concentrations are strongly linked to energy consumption. Approximately 80% of US greenhouse gas emissions are CO<sub>2</sub> emissions produced by the combustion of fossil fuels.<sup>26</sup> Since the industrial revolution in the mid-1800s, both the world's

<sup>25</sup> IPCC, "Climate Change (2007) The Physical Science Basis, a report accepted by Working Group I of the Intergovernmental Panel on Climate Change. Frequently Asked Question 1.3: What is the Greenhouse Effect?", [http://ipcc-wg1.ucar.edu/wg1/FAQ/wg1\\_faq-1.3.html](http://ipcc-wg1.ucar.edu/wg1/FAQ/wg1_faq-1.3.html).

<sup>26</sup> US EPA, 2008. "Inventory of US Greenhouse Gas Emissions and Sinks: 1990 – 2006." EPA 430-R-08-005. [http://www.epa.gov/climatechange/emissions/downloads/08\\_CR.pdf](http://www.epa.gov/climatechange/emissions/downloads/08_CR.pdf).

population and its energy consumption have increased exponentially (Figure B.2.). As society has become technologically advanced, more and more energy has been consistently needed to build homes, offices, and factories, to transport people, food, and goods, and to power air conditioners, refrigerators, televisions, computers and cell phones. Currently, over 85% of world energy is derived from fossil fuel sources (crude oil, coal, and natural gas) and trends suggest that consumption of energy will continue to increase sharply.



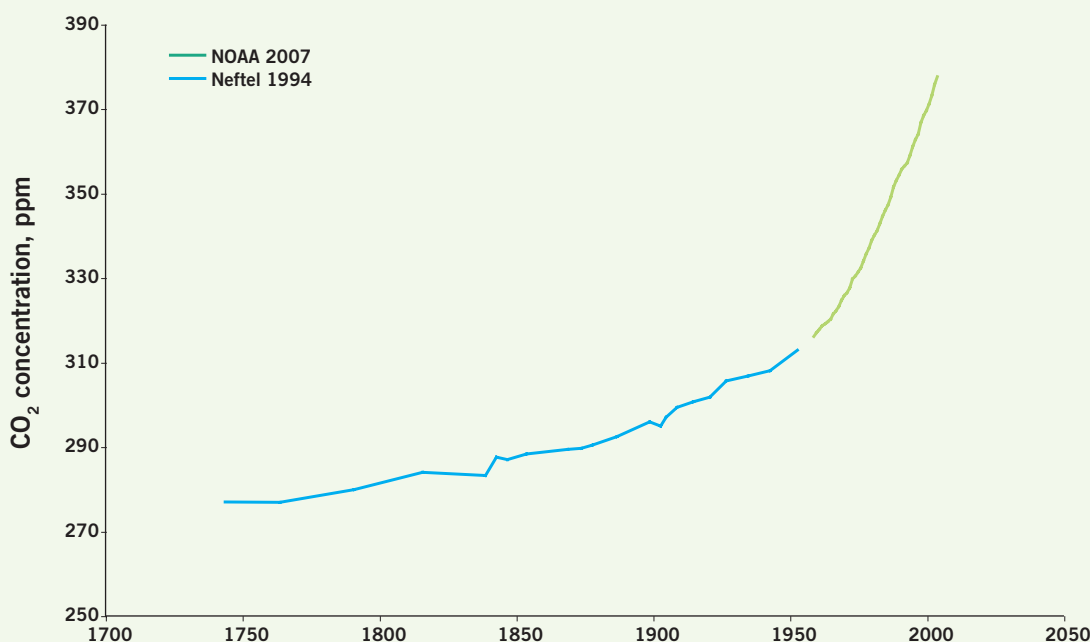
**Figure B.2:** World energy consumption and population over time.<sup>27,28</sup>  
(Mtoe: million tons of oil equivalents.)

<sup>27</sup> Population Division, Department of Economic and Social Affairs, United Nations Secretariat, (1999), "World at Six Billion". <http://www.un.org/esa/population/publications/sixbillion/sixbilcover.pdf>.

<sup>28</sup> Netherlands Environmental Assessment Agency, History Database of the Global Environment (HYDE Database) <http://www.mnp.nl/en/themasites/hyde/index.html>.



Increasing demand for energy has driven a corresponding increase in emissions of CO<sub>2</sub> and the concentrations of CO<sub>2</sub> in the atmosphere, as shown in Figure B.3. Since the pre-industrial era, CO<sub>2</sub> concentrations in the atmosphere have averaged below 275 parts per million (ppm). However, in the last 150 years, CO<sub>2</sub> concentrations have increased exponentially to present levels of over 375 ppm, with the greatest increase seen in the last 50 years. Currently, atmospheric CO<sub>2</sub> concentrations are increasing at the rate of almost 2 ppm per year.



**Figure B.3:** Atmospheric surface CO<sub>2</sub> concentrations over time.<sup>29,30</sup>

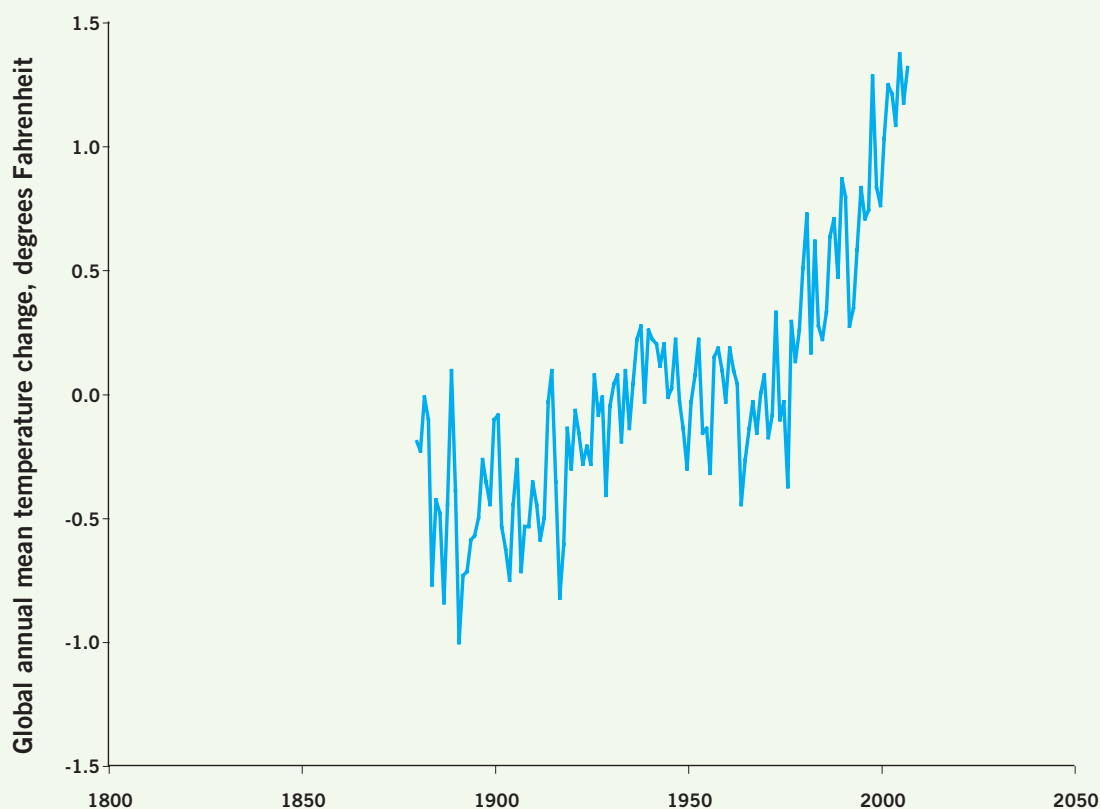
The world's leading scientific body on climate change believes that evidence of global warming of the earth's temperatures is now unequivocal.<sup>31</sup> As atmospheric CO<sub>2</sub> concentrations have increased, a corresponding increase in the earth's global temperature has also occurred, as shown in Figure B.4. Globally, the average surface temperatures have increased by 1 degree Fahrenheit since the 1970s. As with global energy consumption and atmospheric CO<sub>2</sub> concentrations, the rate of global temperature change increased sharply after 1950.

<sup>29</sup> Neftel, A., H. Friedli, E. Moor, H. Löttscher, H. Oeschger, U. Siegenthaler, and B. Stauffer, (1994), "Historical CO<sub>2</sub> record from the Siple Station ice core. In Trends: A Compendium of Data on Global Change." Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory, U.S. Department of Energy, Oak Ridge, Tenn., U.S.A. <http://cdiac.esd.ornl.gov/trends/co2/siple.htm>.

<sup>30</sup> National Oceanic and Atmospheric Administration (NOAA), Earth System Research Laboratory, Global Monitoring Division, (2007), "Monthly Mean CO<sub>2</sub> concentrations from Mauna Loa, Hawaii." (Accessed May 29, 2007). [http://www.esrl.noaa.gov/gmd/ccgg/trends/co2\\_mm\\_mlo.dat](http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_mm_mlo.dat).

<sup>31</sup> IPCC, (2007) "Climate Change 2007 – The Physical Science Basis", Contribution of Working Group I to the Fourth Assessment Report of the IPCC.



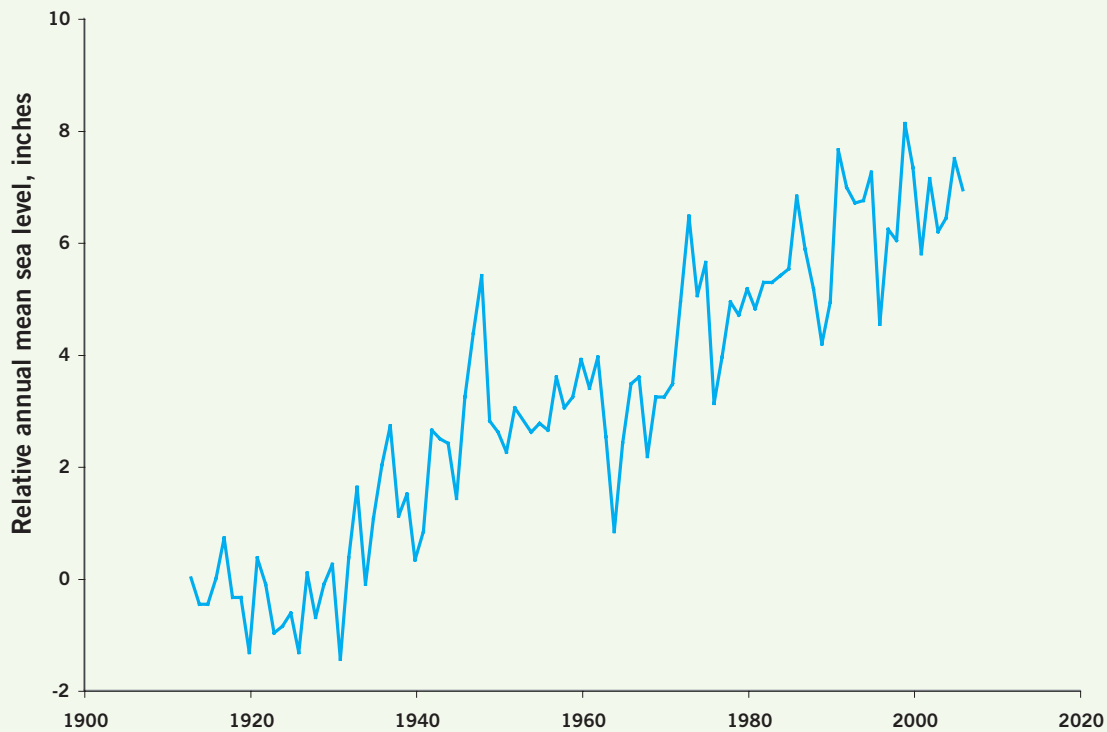


**Figure B.4:** Global annual temperature change over time.<sup>32</sup>

Scientists predict increased temperatures will result in increased sea levels by two mechanisms. First, sea levels will rise due to thermal expansion. As water is warmed, the volume the body of water occupies will also increase, causing sea level rise. Second, as temperatures increase, more

<sup>32</sup> National Aeronautics and Space Administration, Goddard Institute for Space Studies, (2008), "Global Annual Mean Surface Air Temperature Change", <http://data.giss.nasa.gov/gistemp/graphs/>.

ice in the Arctic and Antarctic regions will melt, increasing the total amount of water in the oceans and increasing sea level. Figure B.5 presents historical sea level measurements at Key West, Florida, which has been steadily increasing since 1920.



**Figure B.5:** Mean annual sea level rise in Key West, Florida over time.<sup>33</sup>

To limit the impact of global warming, the IPCC and other scientists have recommended dramatic reductions in CO<sub>2</sub> emissions by 2050.<sup>34</sup> Most are targeting reductions of 80% or greater by the year 2050 to stabilize the earth's climate.

<sup>33</sup> Proudman Oceanographic Laboratory. "PSMSL Monthly and Annual Mean Sea Level Station Files", [http://www.pol.ac.uk/psmsl/psmsl\\_individual\\_stations.html](http://www.pol.ac.uk/psmsl/psmsl_individual_stations.html).

<sup>34</sup> IPCC, (2007), "Climate Change 2007: Synthesis Report. Summary for Policymakers." [http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4\\_syr\\_spm.pdf](http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr_spm.pdf).





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INSITUATIONALIZING CLIMATE PREPAREDNESS IN MIAMI-DADE COUNTY, FLORIDA

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BACKGROUND

Miami-Dade County is a diverse, low-lying county of approximately 2.5 million inhabitants<sup>1</sup>, located along the subtropical stretches of south-eastern Florida. Covering 5,040 km<sup>2</sup>, the County is a dynamic, economic and culturally diverse coastal community that is bordered by two national parks: Biscayne National Park and Everglades National Park. The County is comprised of 35 municipalities and a large unincorporated area. There are 156 nationalities represented in the County, with approximately fifty percent of the residents being foreign born and over 100 different languages spoken. Within the County, 62% of the population is Hispanic, 18% are non-Hispanic White, and 18% are non-Hispanic Black. Due to this diversity, Miami-Dade County regularly conducts business in three different languages – English, Spanish, and Creole.

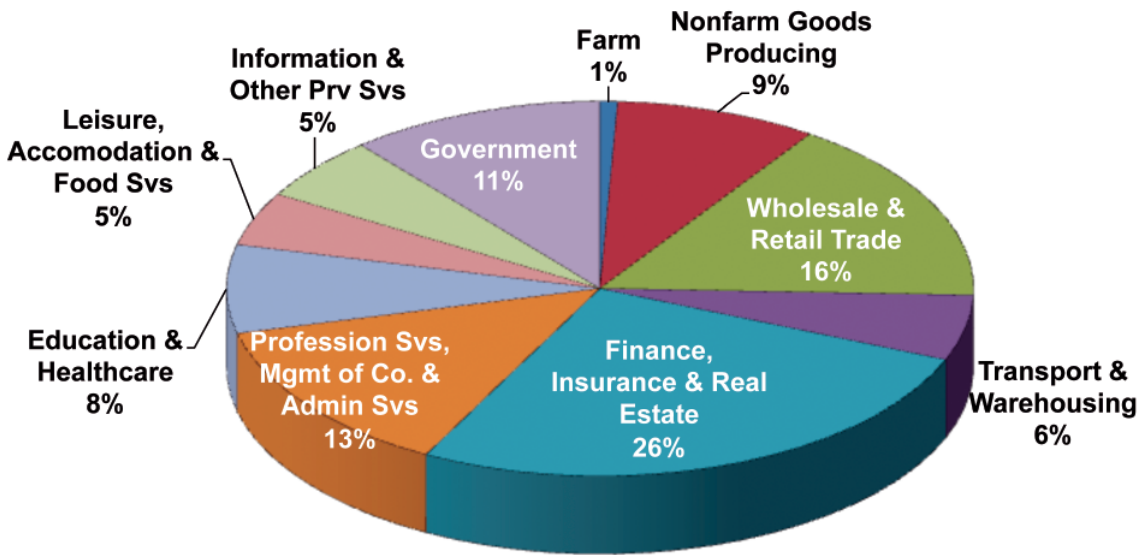


Figure 1: Downtown Miami-Dade County (background) and residential communities (foreground) located adjacent to Biscayne Bay. (Miami-Dade County photograph).

Miami-Dade County has a diverse economy that produces an annual Gross Domestic Product (GDP) of approximately \$111 billion – 90% of which is from the private sector (Figure 2). The largest industries within the private sector are finance, real estate and insurance, accounting for 26% of County-wide GDP. Commerce (which is made up of wholesale, retail, transportation and warehousing services) directly contributes 22% of GDP. Goods producing sectors like manufacturing and construction account for about 10% and Education and Healthcare add another 8%. Hotel, food service, and leisure businesses, a large

Figure 2: Diagram of Miami-Dade County's Gross Domestic Product.

Composition of Miami-Dade Gross Domestic Product



<sup>1</sup> Miami-Dade County's population is projected to increase to 3.2 million by 2030

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part of the tourism sector, directly account for 5% of GDP, but when things such as air travel, shopping, and the value of the cruise industry are factored in, the economic importance of tourism is much larger than 5%<sup>2</sup>. Government operations contribute roughly 10% to annual GDP. The County government's budget was approximately \$7.8 billion in Fiscal year '09 – '10, comprised of a \$4.7 billion operating budget and a \$3.1 billion capital budget.

Miami-Dade County has a two-tier form of government with the County providing regional services, as well as city-type services, to a large unincorporated area, as well as to some of the thirty-five separate municipalities within the County. These services range from public housing and public utilities to public safety and environmental protection (Figure 3). The County Mayor is elected Countywide and is the administrative head of county government. Mayor Carlos Alvarez, the current County Mayor, appoints all department directors. In addition to a Mayor, the County also has a Board of County Commissioners (BCC), which consists of 13 members elected by the thirteen districts in the County. The Board of County Commissioners is the legislative branch of county government.



Figure 3: Miami-Dade County is a large metropolitan government providing regional services such as transportation, as well as basic city services such as public safety and social services. The County's goal is to integrate sustainability into its entire operations and services.

## A HISTORY OF ENVIRONMENTAL LEADERSHIP

Miami-Dade County has been leading the environmental charge, both domestically and internationally, for over twenty years. Since 1991, the Board of County Commissioners has passed over 100 pieces of sustainability legislation covering climate change, energy and water efficiency, alternative energy and fuels, green buildings, and green jobs. Beginning in 1990, County representatives played an instrumental role at the United Nations World Congress of Local Leaders and aided in the formation of a global organization designed to ensure that the local voice was integrated into international policy making. This organization was created in 1990 as the International Council for Local Environmental Initiatives and is known today as ICLEI-Local Governments for Sustainability (ICLEI).

<sup>2</sup> Dr. Robert Cruz, Miami-Dade County's Chief Economist



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As an inaugural member of ICLEI, Miami-Dade County began participating in the Cities for Climate Protection (CCP) campaign in 1993 and started working to reduce greenhouse gas emissions. Over the course of the next two decades, Miami-Dade County undertook a slew of efforts that have not only solidified their national and international leadership in climate mitigation, but have also established them as a leader in climate adaptation and sustainability. Some notable environmental accomplishments achieved by the County to-date include:

- One of only five local jurisdictions to regulate the sale of stratospheric ozone depleting compounds in 1991
- By 1993, the County had adopted its Urban CO<sub>2</sub> Reduction Plan, which led to a reduction and avoidance of approximately 34 million tons of carbon dioxide (CO<sub>2</sub>) equivalent emissions (roughly equivalent to taking 8.8 coal fired power plants offline for a full year<sup>3</sup>)
- Creation of the Climate Change Advisory Task Force (CCATF) in June of 2006
- Joining the Chicago Climate Exchange (CCX) in 2007 for a fuel-reduction pilot
- Becoming a pilot community in ICLEI USA's Climate Resilient Communities™ adaptation program in 2007
- Creation of an Office of Sustainability in 2007 to streamline environmental, social, and economic efforts
- Establishment of a Sustainable Buildings Ordinance and Program in 2007 to advance sustainable and environmentally responsible planning, design, construction and operation of County buildings
- Committing to the "Cool Counties" goals and objectives, to reduce greenhouse gas emissions by 80% by 2050
- In 2009, Miami-Dade County leapt forward in its implementation efforts with four significant initiatives. These efforts were catapulted forward by the award of \$12.5 million dollars from the federal Energy Efficiency and Conservation Block Grant (EECBG). This has not only facilitated implementation of several energy efficiency and renewable energy projects, but also allowed the County to expand the Office of Sustainability. Concurrently, Miami-Dade County was chosen to pilot ICLEI's Sustainability Planning Toolkit, which initiated the creation of the County's comprehensive sustainability plan, "GreenPrint - Our Design for a Sustainable Future" (GreenPrint). This was also the year the ground-breaking Southeast Regional Climate Change Compact (Compact) was formed, which aligns Miami-Dade County and three other counties in southeastern Florida (Broward, Monroe, and Palm Beach) to regionally collaborate on climate mitigation and adaptation efforts.



Figure 4: Picture of Miami Beach.

<sup>3</sup> EPA Greenhouse Gas Equivalencies Calculator:

<http://www.epa.gov/cleanenergy/energy-resources/calculator.html#results>

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## A NEED FOR CLIMATE CHANGE ADAPTATION

As a coastal community located at sea level and surrounded by water on three sides, with typical land elevation only three to ten feet above mean high water, Miami-Dade County is acutely aware of the dangers posed by climate change. Climate changes, including sea level rise, increases in temperature, changes in precipitation patterns, and changes in the intensity and/or frequency of extreme events all threaten the health and safety of residents, the integrity of infrastructure, and the vitality of regional ecosystems. In 2007, the Organization for Economic Cooperation and Development (OECD) quantified the vulnerability of various municipalities across the world towards climate change and identified Miami-Dade County as having the highest amount of vulnerable assets exposed to coastal flooding (for the 2070's) with a projected potential cost of approximately \$3.5 trillion<sup>4</sup>.

Moreover, the County's geographical location at the tip of a peninsula, its large, dense population, and the reality that many key economic drivers for the county are weather dependent (e.g. tourism and agriculture), have created a clear impetus to plan for climate change.

To help start with the climate planning process, the County worked with local and regional climate scientists to review regionally specific climate models. These climate models predict an increase in temperature over the next 50 years between 4.5–9 degrees Fahrenheit (depending on the greenhouse gas emissions scenario), with a notable increase in the number of days over 90 degrees<sup>5,6</sup>. The greatest temperature increases are expected during the summer months – which can have significant implications on energy demand, exacerbate heat waves, and lead to greater evapo-transpiration, resulting in an impact on water supply, as well as local agriculture. These increases in temperature could also lead to more heat related illnesses and



Figure 5: Flooding from October 2010 high tide event.

<sup>4</sup>Nicholls, R.J., Hanson, S., Herweijer, C. et al. (2007). Ranking of the world's cities most exposed to coastal flooding today and in the future. OECD Executive Summary Report.

<sup>5</sup>Karl, T.R., Melillo, J.M., and Peterson, T.C. (2009). Global climate change impacts in the United States. Cambridge University Press.

<sup>6</sup>Nakićenović, N. and Swart, R. (2000) Special report on emissions scenarios: A special report of Working Group III of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, UK, and New York.



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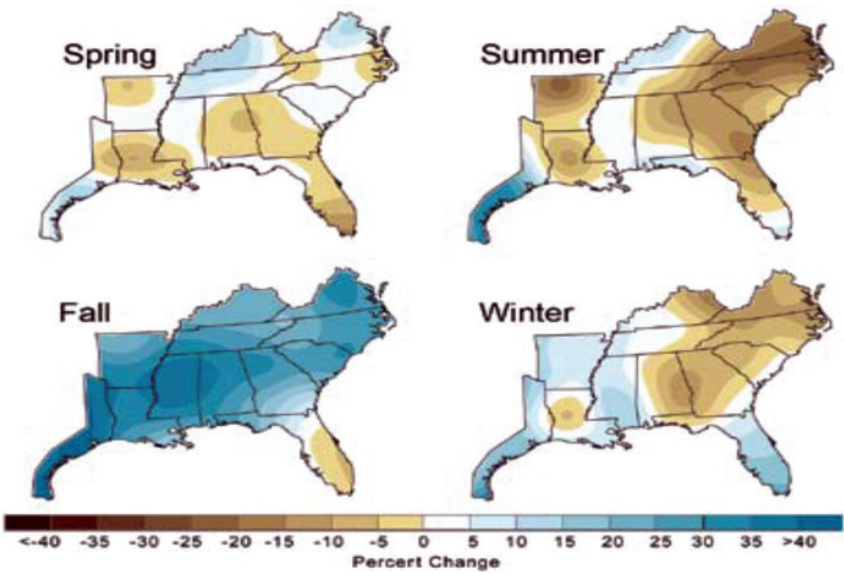


Figure 6: Observed Changes in Precipitation 1901 – 2007. Source: Karl et al., 2009.

deaths, the spread of disease vectors, shifts in agricultural production and growing areas, droughts and excessive crop damage, and affect the viability and habitat of native plant and animal species.

Changes in precipitation are also likely to have significant impacts in the greater Miami–Dade County region. Figure 6 demonstrates that in South Florida, there is generally less precipitation during the fall and spring, and generally more in the summer and winter. The darker the color, the greater the percent change since the early 1900’s. In the future Southeast Florida is likely to see up to 20% less rainfall<sup>7</sup>.

Moreover, locally derived data indicates that there has been an increase in heavy downpours in the region and an ’09 report by the Florida Oceans and Coastal Council<sup>8</sup> indicates this trend is likely to increase in



Figures 7 and 8: Flooding from June 2009 (left) (photo courtesy of Eric Blake, National Hurricane Center) and low river flow (right)

<sup>7</sup> 2007 report by the IPCC

<sup>8</sup> Florida Oceans and Coastal Council. *The effects of climate change on Florida’s ocean and coastal resources. A special report to the Florida Energy and Climate Commission and the people of Florida.* Revised Jun. 2009. Tallahassee, FL., 2009: 34. Print.

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the future. As example, on June 5, 2009, the County experienced a sample downpour in which 9.3 inches of rain fell on South Beach, almost all within a three hour window of time. This inundation of rain resulted in as much as 3 feet of standing water on streets and garages and lead to stalled cars and road closures. However, while the region may experience periods of heavy downpour, these periods are likely to be combined with longer dry spells (or droughts) (Figures 7 and 8). Droughts are of serious concern for Miami-Dade County. From November 2008–April 2009 South Florida experienced the second driest period on record which led to severe to extreme drought conditions and the spread of wildfires (i.e. in Collier County more than 30,000 acres burned during this time frame). Moreover, during this time (December 2008–February 2009), Miami and Fort Lauderdale experienced the driest winter on record, with rainfall amounts of 0.74 and 0.39 inches, respectively.



Figure 9: Beach erosion from coastal storm.

Hurricanes and tropical storms are also important weather patterns Miami-Dade County is taking into consideration. While the science and predictions are still uncertain regarding climate change effects on hurricanes, it is generally thought that the frequency of storms may decrease, but the intensity may increase. For Miami-Dade County this means the possibility of more intensive storms that could cause more widespread damage to infrastructure (buildings, powerlines, water and sewer lines, etc.) and social systems. More intense hurricanes and tropical storms also mean a heightened threat of beach erosion and the degradation of natural habitats. Additionally, more intense tropical storms/hurricanes combined with sea level rise could mean increased migration from nearby island nations, which will bring additional strain on County systems and infrastructure, not to mention creating strain on cultural systems within the community.

Another notable area of climate concern for Miami-Dade County is sea level rise. According to NOAA, the mean increase in sea level trend at the Key West tide gauge was approximately 2.24 millimeters per year from 1913 to 2006, which is roughly equivalent to a change of 0.73 feet in 100 years<sup>9</sup>. Many scientists believe this rate may dramatically increase due to polar ice cap and glacial melt, in addition to thermal expansion resulting from increased ocean temperatures. The resultant sea level rise is expected to exacerbate coastal and inland flooding, as well as erosion, which the region is particularly vulnerable to along the beaches (Figure 9), coastal habitats, and within Everglades National Park. The County currently spends approximately six million dollars annually in beach restoration efforts, which would likely increase as sea level rise increases.

In addition, sea level rise could also lead to increased storm surge damage, population displacement, damage to infrastructure, and the spread of infectious diseases. At-risk infrastructure includes utility infrastructure along the coast such as water treatment plants, electric plants, transportation corridors, and landfills, all of which provide critical municipal services. Furthermore, storm surge inundation and high wind impacts from tropical storms are additional issues of concern for the social, political and natural systems of the County.

<sup>9</sup> United States. Dept. of Commerce. National Oceanic and Atmospheric Association (NOAA). Tides and Currents, Mean Sea Level Trend, 8724580 Key West, Florida. Center for Operational Oceanographic Products and Services, 9 Sep. 2008. Web. 15 Aug. 2010.

< [http://tidesandcurrents.noaa.gov/sltrends/sltrends\\_station.shtml?stnid=8724580](http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8724580) >

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Sea level rise also poses many significant water-related challenges for Miami-Dade County. The substrate in the Southeast Florida region is composed of porous limestone which is extremely transmissive, allowing water to move freely between the pores of underground rock. At present, the County's sole source for drinking water supply is the Biscayne Aquifer, located just a few feet below the ground surface. Because of the porous nature of the substrate, the Aquifer is not only susceptible to contaminants, but is also hydrologically connected to the ocean and therefore susceptible to saltwater intrusion (Figure 10). As sea level rises, hydrostatic pressure will cause the saltwater front to move further inland, threatening contamination of drinking water wells with saltwater.

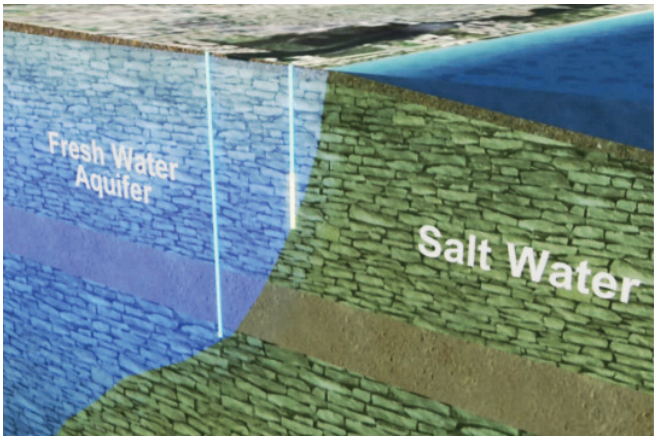


Figure 10: Graphic depiction of interaction of Biscayne Aquifer to surrounding salt water. Image courtesy of South Florida Water Management District.

The local substrate and changes in the water table also pose difficult challenges in regards to protecting the surrounding communities from flooding. As sea level rises, the ground water table will rise closer to the surface, reducing the capacity to absorb stormwater and run-off during heavy rain and storm surge events, as well as progressively compromising the effectiveness of the gravity-driven wastewater and storm water infrastructure. Furthermore, the porous nature of the substrate also precludes traditional methods of constructing barrier walls to stave off rising ocean waters.

While direct impacts from sea level rise and coastal flooding are clear motivators for climate adaptation planning in Miami-Dade County, there are several other issues of concern. One notable example is the agricultural sector, which contributes roughly \$2.5 billion annually<sup>10</sup> to the County's economy, and can be significantly impacted by weather and climate change. Changes in precipitation and temperature patterns, as well as soil salinity from salt water intrusion, can change the type and range of plants and crops that can be grown. Additionally, heavy rain events and freezes can lead to extensive crop damage. For example, the January 2010 extended cold weather and freeze led to over \$280 million in agricultural losses<sup>11</sup>. These climate stressors, combined with increasing pressure from development and population growth could pose significant impacts to the County's agricultural future.

## PREPARING FOR CLIMATE CHANGE WHILE ADVANCING LOCAL SUSTAINABILITY

Recognizing the increased urgency for dealing with climate change, the County created a formal Climate Change Advisory Task Force (Task Force) that has been instrumental in providing guidance and recommendations on both adaptation and mitigation issues to the Miami-Dade Board of County Commissioners. Created in June of 2006 through the adoption of Ordinance 06-113 sponsored by Commissioner Natacha Seijas, the Task Force includes 25 appointed members and



Figure 11: Miami skyline.

<sup>10</sup> Estimated economic impact, for Miami-Dade County, according to the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS)  
<sup>11</sup> ibid



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over 150 additional individuals who represent key sectors of the community, such as non-profit organizations, universities, building and architecture firms, national parks representatives, regional and state planning agencies, private sector business, federal partners and community residents.

Seven sub-committees were formed to focus on key areas of concern with the County; each chaired by a member of the Task Force and comprised of participants from the Task Force and the public. The seven committees include:

- Built Environment Adaptation
- Economic, Social, and Health
- Alternative Fuels and Transportation
- Energy and Buildings
- Science Committee
- Intergovernmental Affairs
- Natural Systems Adaptation

Meeting monthly, the Task Force has been a vehicle for community engagement in the County's climate change efforts, ensuring that voices from important community sectors are integrated into long-term adaptation and mitigations strategies. While the Task Force does not have the authority to make decisions, it does provide critical input and feedback, and helps to facilitate support from the community. To date, fifty-seven recommendations have been forwarded to the Board of County Commissioners and several are already being implemented. Sample activities already underway in the County that have been recommended by the Task Force include:

- The County Manager met with key department directors in the fall of 2008 and began the discussion of how to start incorporating climate change planning into department strategic plans. The County partnered with the National Oceanic and Atmospheric Association (NOAA) in March 2010 to provide an initial introduction and training for climate adaptation to department heads and operational staff to expedite this process.
- Through the Southeast Florida Regional Climate Compact's Regional Vulnerability Assessment Technical Work Group and NOAA, the County and Compact partners have been working with the U.S. Geological Survey (USGS) and the U.S. Army Corps. of Engineers (USACE) to build consensus on climate vulnerability and sea level rise mapping and planning parameters, utilizing regional digital elevation data and models. This information will be used in conjunction with Miami-Dade County's Stormwater Master Plan to identify flood hazard prone areas and create planning maps and tools for use in the comprehensive planning and zoning process.
- County staff has contacted the National Park Service (NPS), U.S. Geological Survey (USGS), Everglades National Park (ENP) and the South Florida Water Management District (SFWMD) to establish a team to work on a Pilot Program to assess the feasibility of using existing monitoring efforts and the information collected during this monitoring as indicators or "vital signs" of climate change.
- The Evaluation and Appraisal Report that will be going to the Board of County Commissioners in January 2011 includes a recommendation for the County to initiate an analysis on climate change and its impacts on the built environment with an eye towards addressing development standards and regulations related to investments in infrastructure, development/redevelopment and public facilities in hazard prone areas.



Figure 12: Everglades National Park.

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- The Evaluation and Appraisal Report that will be going to the Board of County Commissioners in January 2011 also includes a recommendation for the County to establish Climate Change evaluation criteria, to be used to evaluate proposed new development and redevelopment or assess the suitability or proposed use(s), density and/or intensity of use(s), and the level or risk of exposure to climate change impacts, among others.
- County staff has begun working with the Epidemiology, Disease Control and Immunization Services program of the Miami–Dade Health Department to create a working group to track and analyze potential climate change-related health impacts.
- The Office of Sustainability is working with the Museum of Science, Department of Cultural Affairs, and the Library Department to create and fund educational exhibits on climate change and sustainability in the region’s museums.

In addition to providing specific climate mitigation and climate adaptation recommendations, the Task Force is coordinating activities with the Office of Sustainability to help ensure that climate concerns are integrated into the County’s soon-to-be released sustainability plan, GreenPrint. Many of the other Task Force recommendations are being further analyzed, or incorporated as specific initiatives into GreenPrint. This includes the County’s climate action plan, which is an integral component of GreenPrint that will address both mitigation and adaptation planning and actions. The goal of GreenPrint is to carefully analyze and work through the more difficult issues around community sustainability and to enable the County to move forward and plan in a sensible and calculated manner.



Development of GreenPrint is based on a Sustainability Planning Toolkit created by ICLEI in collaboration with New York City. The Plan is being developed to serve as an overarching community-wide sustainability plan to reaffirm, establish and synchronize the County government and community sustainability goals, initiatives, and measures. It will integrate with existing County efforts and additional community plans and will not only make County government operations greener, but will also improve the community’s overall sustainability and quality of life.

In the development of GreenPrint and the climate protection work, the County is adhering to the following guiding principles:

- The County will lead by example;
- The concept of sustainability will guide policy and decision-making;
- Metrics and targets will be used to define goals and measure progress;
- The County will collaborate with local municipalities and neighboring counties to create a sustainability movement among multiple local jurisdictions;
- Partnerships between jurisdictions and between the public and private sector are necessary to achieve sustainability goals;
- Transparency and accountability will guide the County’s sustainability actions;
- Initiatives in the plan will be designed to be aggressive but achievable;
- The County will ensure the benefits of sustainability policies are equitably distributed to all residents; and
- The plan will reflect community demographics and the economy and include key sustainability components addressing both County operations and the community as a whole.

Overall, the goal of the County is to balance and institutionalize sustainability and climate action by building these concepts and strategies into the county’s standard operations and planning processes.



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## BUILDING PARTNERSHIPS

To further support the County’s sustainability, climate change mitigation and climate change adaptation efforts, the County is leveraging support and engagement from numerous levels and organizations. As example, efforts to address greenhouse gas emission reductions are being supported by the federal Energy Efficiency and Conservation Block Grant (EECBG) program. Additional resources are being further leveraged on a regional basis through the U.S. Department of Transportation’s Livable Communities Program, which is a collaboration between the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Housing and Urban Development (HUD). Miami-Dade is one partner in a seven-county regional partnership that was recently awarded \$4.25 million by the Livable Communities Program.



Figure 13: Port of Miami.

This partnership was created through the South Florida Regional Planning Council and the Treasure Coast Regional Planning Council, in order to plan, design and implement a multi-jurisdictional regional plan for sustainable development.

As previously mentioned, the County has partnered with the National Oceanic and Atmospheric Administration (NOAA)’s Digital Coasts Initiative, to train County department staff on potential climate change impacts and implications to County operations. As part of this partnership, NOAA will be developing a case study about Miami-Dade County, which will serve as an example for other coastal communities. Furthermore, this partnership led to Miami-Dade being one of only six localities chosen nation-wide to host a public meeting of President Obama’s Interagency Climate Change Adaptation Task Force, allowing the County to play an integral part in forming national climate policy.

In addition, the County is working directly with the U.S. Geological Survey (USGS), to develop an integrated surface-groundwater model to help better understand the interactions between surface and ground water, and the potential effects of sea level rise on these water resources. The ultimate goal is to develop models for the South Florida region that will allow data and different models between the counties to be exchanged. This approach of tackling climate change issues at multiple levels will continue to be a key to the County’s future success.

Moreover, the County was instrumental in the creation of the Southeast Florida Regional Climate Change Compact, a four-county partnership between Broward, Miami-Dade, Monroe, and Palm Beach Counties focused on enhancing regional collaboration around climate mitigation and adaptation. The Compact partners work collaboratively on:

- Developing a joint policy position urging the United States Congress to pass legislation that recognizes the unique vulnerabilities of Southeast Florida to the impacts of climate change and to further a joint position that includes specific recommendations regarding the allocation of federal climate change funding based on vulnerability to climate change impacts.
- Developing additional legislative policy statements relating to climate change and future legislation to be considered by the Congress of the United States representing, in part or in whole, districts within the area covered by the compact.





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- Developing joint position statements on proposed State legislation and energy/climate policies.
- Developing joint position statements that may be considered by the Florida Legislature for transmittal to the Legislative Delegation representing, in part or in whole, districts within the area covered by this compact.
- Development of a Southeast Florida Regional Climate Change Action Plan that, at a minimum, includes the following components:
  - A baseline of greenhouse gas emissions for Southeast Florida;
  - Strategies for coordinated emission reductions throughout the built environment to include the use of energy efficiency, energy conservation, and demand-side renewable energy resources;
  - Strategies for coordinated emission reductions from the transportation sector to include increased reliance on public transit, emerging vehicle technologies, and advanced biofuels;
  - Strategies for coordinated emission reductions resulting from changes in local and regional land use; and
  - Strategies for the coordinated regional preparation for and adaptation to a rapidly changing global environment based upon regional mapping of projected sea-level rise and any resulting amplification of localized impacts of tropical storm events. Such strategies shall incorporate climate preparation concerns for the regional economy, regional infrastructure and built environment, social and cultural needs, and natural systems within the four counties party to the compact.



Figure 14: Flooding at Matheson Hammock from October 2010 high tide event.

As part of the Compact, each County committed appropriate staff resources and expertise, within budget constraints, to participate in the development of a Southeast Florida Regional Climate Change Action Plan.

## CHALLENGES TO ADAPTATION

Throughout Miami-Dade County's adaptation and sustainability process, the County has faced numerous challenges and overcome many obstacles which have resulted in a series of potential stumbling blocks that other communities should be cognizant of during their climate preparedness efforts:

- **Complexity of Issue:** Climate change is a complex issue with multiple impacts that span all agencies/departments, and all sectors of society. This can be an enormous hurdle to overcome and



Figure 15: Crop damage after freeze in January 2010.

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poses difficulty in conveying the need for action. Communities need to acknowledge this complexity but not let it be a barrier to action.

- **Scientific Uncertainty and Timeframe:** One significant obstacle to overcome is determining which climate change projections to utilize for planning from the numerous and varied impact projections that currently exist. The extended timeframe of projected impacts (e.g., 2050, 2100), in conjunction with shorter-term decision-making, create a challenging political dichotomy. This is further exacerbated by the reality that some impacts may not be felt until far into the future but require tough decisions to be made today.
- **Scale and Complexity of Data:** Vast amounts of data need to be gathered and analyzed in order to guide decision making. In addition, systems, programs, and security mechanisms need to be created to store and manage this data to ensure data accuracy and integrity. Creation of these systems can be a lengthy and resource-intensive process, but is important for tracking changes and success.
- **Competing and Immediate Needs:** Miami-Dade County provides all basic services to residents in the County. Climate change impacts will affect most of these services but can also be seen as a separate priority which creates competition between existing, more immediate needs and the need to take action now to prepare for future challenges. Finding ways to integrate climate concerns into existing community concerns can lessen this competition.

- **Current Economic and Budget Constraints:** Communities across the U.S. are currently grappling with how to deliver basic services while facing a severe budget shortfall. Miami-Dade County is no different and is struggling with integrating climate adaptation and preparedness activities into operations, while also dealing with the reality that this is likely to create added burdens on already strained budgets.



Figure 16: Damage after coastal storm.

- **Land Use Realities:** Can coastal development really be thwarted? In regards to climate change, it's clear that it should, but how can this become a reality? Making tough land-use decisions will require support from federal, state, regional, and local counterparts, which can be challenging to foster, but will be critical for success.
- **Turning Science in to Action:** How does a community translate complicated and often 'difficult-to-understand' issues into action? This, along with effective communication, is the key to moving forward and aggressively addressing and acting on climate change.
- **Effective Communication:** The most important stepping stone to climate change policy can often be the most challenging obstacle to overcome. Effective communication is pivotal in dealing with any community-wide issue.

## OPPORTUNITIES FROM CHALLENGES

Miami-Dade County has found that obstacles can become opportunities and it is this perspective that has enabled them to address many of the challenges listed above. The cornerstones in making this happen are effective communication, linkages and partnerships. As previously mentioned, the Climate Change Advisory Task Force has played a significant role in engaging and communicating to both the community and decision-makers. Furthermore, collaboration and communication between staff and members of the climate task forces in other southeastern Florida communities has helped lead to the Regional Climate



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Compact that has become so instrumental in drawing national and international attention, as well as additional resources, to the region. Working together on a regional level allows each county to build upon their individual efforts and helps provide validity when addressing these complex and uncertain climate change issues and projections. This in turn facilitates navigation through the politics and tough decisions that often accompany climate change adaptation planning and implementation, and helps turn science into action.

On yet another level, Miami-Dade County is reaching out and engaging the community through partnerships with a local grass roots organization called Dream in Green. Through this program, homeowners are being educated in a language they can understand and given resources to increase their energy efficiency at home and at work. Participants learn



Figure 17: Aerial view of Bayside.

how their simple actions tie in to the overall picture of climate change and how they, as individuals make a difference which can be amplified across the county, the nation, and even the world. As is often the case, saving money is the hook and this hook is even more effective in the current economic times – once again, turning an obstacle into an opportunity.

Linking climate change information and action to existing programs is crucial – climate change cannot be seen as competing against current needs or it will likely fall to the bottom of priorities due to more immediate needs and the inherent lag time of suspected impacts. This is particularly true during the existing tough economic conditions. Rather, climate change information and action must be integrated into local government planning and standard operations as seamlessly as possible. Miami-Dade has found a good opportunity for this with its hazard mitigation and emergency management planning, as well as stormwater master planning. Since many aspects of these programs also address future projected climate change impacts, this is a natural fit that can improve management of existing hazards and reduce the economic burden from both current and future hazards.

## LESSONS LEARNED

Any local government tackling climate change will have a wide array of challenges to overcome. Because of its long history of climate action, Miami-Dade County has had time to gain experience in tackling many obstacles and learned a few lessons along the way that have been instrumental in creating a culture conducive to adaptation planning. One of the most critical, and perhaps evident lessons learned, is the importance of building upon existing successful efforts. Evaluating and assessing what has already been implemented can provide a solid foundation to move forward from and build upon. This can be anything from existing plans or programs, to stakeholders and stakeholder driven efforts. Miami-Dade County has taken important steps and gained critical knowledge in climate change adaptation through implementation of its existing Stormwater Master Plan and Local Hazard Mitigation Strategy. Because the region has experienced numerous hurricanes over the past two decades, the development of these programs has been critical in anticipating, addressing, and recovering from tropical storm events. As the County began adaptation planning, it became apparent that these programs are also a critical component in a successful climate adaptation plan and are serving as an important foundation as Miami-Dade County moves forward.

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Similarly, greenhouse gas (GHG) emissions reduction efforts must continue in earnest as adaptation proceeds. Even if a local government has not been formally implementing a climate mitigation plan, it is likely that they have taken steps to save money by reducing fuel or energy use. These successful efforts, no matter how small, can again form a foundation to build upon. Greenhouse gas mitigation efforts should expand and intensify as part of the adaptation process rather than being replaced by it and it is important to communicate this fact to the decision-makers and the public. This was one of the first points agreed upon by the members of the Climate Change Advisory Task Force when it was formed, and a committee was established specifically to address this issue. Existing emission reduction efforts were reviewed and numerous recommendations were developed to expand and further these efforts, as well as establish new programs. In addition, Miami-Dade County is leveraging existing initiatives and current federal support through the EECBG Program and others previously mentioned, to expand its mitigation efforts.



Figure 18: Forward-pumping stormwater structure. Photo courtesy of South Florida Water Management District.

Stakeholder involvement from the beginning is essential and it must include both internal (decision-makers) and external (community) stakeholders. While this may also seem self-evident, it is a component that is sometimes bypassed because it can often be challenging and time-consuming. Stakeholder involvement is critically important, not only to generate support, but also to keep initiatives on track and provide checks and balances. Decision-makers are obvious key stakeholders and their buy-in is essential. Experience has shown over and over that without their commitment and leadership, progress and success is highly unlikely. Miami-Dade County has been fortunate to have this support and commitment for many years, as exemplified by its leadership in addressing climate change issues since the early 1990's. Despite this long-standing support, staff made sure upper management and decision-makers were educated on the goals and process of developing GreenPrint from the beginning, and have kept them informed and involved throughout its development. To include public stakeholders, Miami-Dade County has utilized its Climate Change Advisory Task Force and the Mayor's Advisory Board to engage various sectors of the community and gain their support. These groups have provided invaluable input into the development of the climate action plan and GreenPrint through their expert knowledge and experience, and have provided a critical community perspective during the process.

Strategies and plans must be flexible to adapt to new opportunities and overlapping goals. Flexibility is important on several levels. First of all, flexibility facilitates effective incorporation of adaptation policies and strategies into existing programs and initiatives. This is integral to leverage current resources and support, as well as build upon successes. Furthermore, a strategic and effective adaptation plan must also reflect

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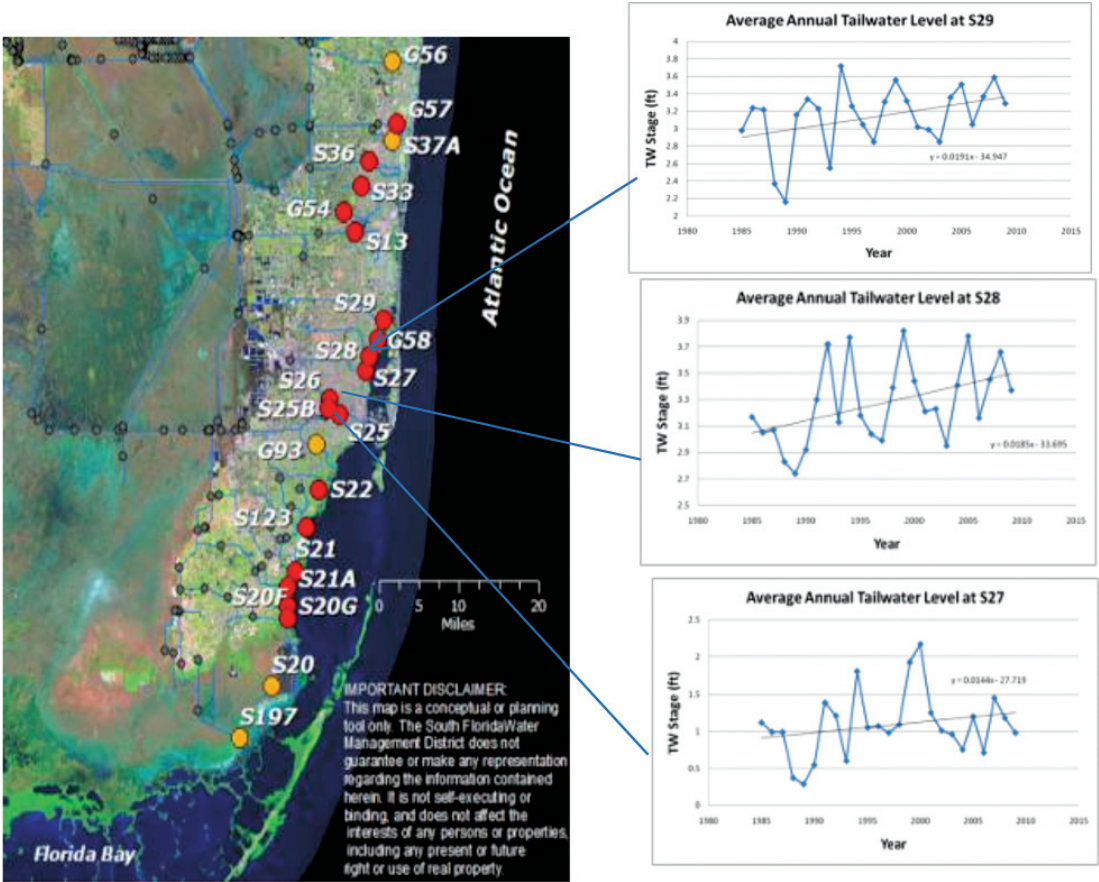


Figure 19: Location of existing coastal structures and the three identified as current priorities for construction of forward pumping stations. Photo courtesy of the South Florida Water Management District.

the latest climate change data and trends, which are constantly changing and being updated. Miami-Dade County will be incorporating new information and data into annual updates of GreenPrint and departments' strategic planning efforts, in order to move forward more effectively and efficiently with building resilience and community sustainability.

Finally, as we see over and over again, local governments can effectively lead in climate adaptation efforts. Rarely has this been more apparent than at this time of strained budgets at all levels of government. Progressive and proactive governments are and should continue to lead the way, rather than waiting for national guidance, resources, and efforts. In this regard, local governments have shown time and time again that they can effectively lead the way when it comes to tackling tough issues – ICLEI members are prime examples and Southeast Florida is leading the way with regional collaboration in the progressive South Florida Regional Climate Compact.

## NEXT STEPS

Miami-Dade County began analyzing and implementing climate mitigation strategies decades before 'climate change' and 'sustainability' became mainstream, and was one of the first local communities to begin actively planning for climate change. Through multiple partnerships and collaborations, the County has established itself as a leader, and has been actively moving forward to make the community more sustainable and more resilient to existing and future projected climate change impacts.

Miami-Dade already has knowledge and skill preparing for certain climate impacts due to their experience of preparing for and recovering from hurricanes. For example, the County already has increased standards



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in building codes to withstand high wind speeds, and has taken measures to improve the overall conveyance of the canal systems for drainage. Moreover, between 2002 and 2006, Miami-Dade County, the State of Florida, and FEMA spent over \$132 million to dredge approximately 120 miles of secondary canals in Miami-Dade County to improve the overall conveyance and drainage capacity of the region. However, more work is needed. The South Florida Water Management District recently conducted a vulnerability analysis of coastal gravity-driven drainage structures in the region and identified three specific structures that have increasing tailwater levels which reduces the discharge capacity (Figure 19). To address this, new forward pumping structures (Figure 18) will be constructed and will be designed with the ability to maintain a certain discharge capacity even with a given amount of sea level rise.

Another key next step for Miami-Dade County is the completion, adoption, and implementation of GreenPrint. As previously mentioned, the County's climate action plan is an integral component of GreenPrint, and focuses on the first five years for implementation of three specific strategies:

- Track local and regional climate change indicators and trends;
- Develop local and regional climate change scenarios depicting various impacts and time frames; and
- Integrate future climate change impacts into community and government decision-making for capital, operational, and land-use issues – this is the most important and ultimate goal – full integration in decision making.

Slated to be completed in late 2010, GreenPrint will be integral in uniting the County's environmental, social, and economic concerns into all County operations. As an example, each year in Miami-Dade County, the administration outlines recommended budget priorities for the Board to consider during the budget process. In a memorandum released on January 29, 2010, titled FY2010–11 Recommended Budget Priorities, County Manager George Burgess stated that “a focus on sustainable initiatives must be woven through all of our services and activities.” This institutionalization of climate and sustainability into existing County operations has been one of the most notable areas of success for the County and is something they intend to continue emphasizing.

Regionally, Miami-Dade County will continue to engage with partners of the Southeast Florida Regional Climate Change Compact to develop regional climate planning scenarios. Additionally, the County will continue to collaborate with Compact partners to create the Southeast Florida Regional Climate Change Action Plan, which will be the roadmap for how to reduce greenhouse gas emissions and increase resilience throughout the region.

While Miami-Dade County has repeatedly demonstrated its leadership and commitment to climate mitigation and adaptation, it is clear that significant work still needs to be done. The good news is that Miami-Dade County is determined to minimize risk and build a lasting, climate resilient community.

## RESOURCES

- To learn more about Miami-Dade's Climate Change Advisory Task Force see: <http://www.miamidade.gov/derm/climatechange/taskforce.asp>.
- To learn more about Miami-Dade's sustainability, climate, and energy initiatives, see: <http://green.miamidade.gov>
- To learn more about ICLEI's Climate Resilient Communities program, see: [www.iclei.org/adaptation](http://www.iclei.org/adaptation).

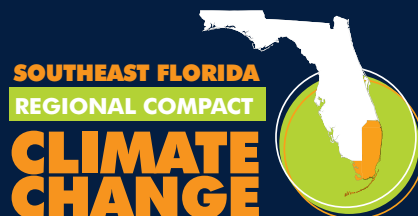


# A Region Responds to a Changing Climate

Southeast Florida Regional Climate Change Compact Counties

Regional Climate Action Plan

October 2012





## **A Region Responds to a Changing Climate**

**Southeast Florida Regional Climate Change Compact Counties**

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|              | E. Analysis of the Vulnerability of Southeast Florida to Sea Level Rise  |     |
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## ACKNOWLEDGEMENTS

This Regional Climate Action Plan is the result of true collaboration – this document and its many supporting publications are the product of existing staff and resources from the various cooperating agencies. No additional public dollars were dedicated to this effort. The Southeast Florida Regional Climate Change Compact was forged during the most difficult national economy since the Great Depression. We came together with purpose and quickly realized the value of sharing resources, expertise and information. Competitors became collaborators. Challenges became successes. At a moment when local government is pressed to achieve maximum efficiency, the Compact enabled a level of intergovernmental cooperation unprecedented in Southeast Florida's history. Many have contributed to the Compact process, including more than 90 members of the public that took the time to submit comments to a previously published draft. While several individuals are recognized here, Appendix C contains a full list of the people and organizations that helped bring this Regional Climate Action Plan to fruition.

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Ms. Rhonda Haag, Monroe County  
Mr. Kevin Wilson, Monroe County  
Mr. Doug Gregory, Monroe County  
Ms. Diana Umpierre, South Florida Water Management District  
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Mr. Chris Bergh, The Nature Conservancy

### **Joint Policy Advisory Team**

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Mr. Todd Bonlarron, Palm Beach County  
Mr. Robert Robbins, Palm Beach County  
Ms. Bonnie Finneran, Palm Beach County  
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Mr. Michael Roberts, Monroe County  
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# I. Executive Summary

Welcome to the first Southeast Florida Regional Climate Action Plan. The Southeast Florida Regional Climate Change Compact (Compact), a unique and collaborative effort among Palm Beach, Broward, Miami-Dade, Monroe Counties, their municipalities and partners, has worked over the past two years to develop this plan with an initial five-year horizon. The plan is a critical milestone of the Compact, entered into by Palm Beach, Broward, Miami-Dade, and Monroe Counties in January 2010. Much of the Compact's work up to this point has served to unite, organize, and assess our region through the lens of climate change in setting the stage for action. Specific accomplishments include the development of regionally-consistent methodologies for mapping sea-level rise impacts, assessing vulnerability, and understanding the sources of regional greenhouse gas emissions. Collectively, these work products provide the foundation for this Regional Climate Action Plan, which calls for concerted action in reducing greenhouse gas emissions and adapting to regional and local impacts of a changing climate. The recommendations presented here aim to accomplish those goals while also serving to protect the assets of the region's unique quality of life and economy, guiding future investments, and fostering livable, sustainable and resilient communities.

The Compact was established with a strong recognition of the region's diversity and its commonalities. It accepted the varying degrees of progress in the areas of climate change adaptation and mitigation in order to inform, to improve, and to advance regional planning efforts together. This Regional Climate Action Plan too recognizes the diversity of Southeast Florida, yet provides the common framework for **Sustainable Communities and Transportation Planning** to be aligned across the region, as implemented. Inevitably this will occur at various stages and varying degrees, but with the benefit of working within a regional context. This is Southeast Florida, with all its uniqueness; the plan recognizes the need to protect and address our vulnerable **Water Supply, Management and Infrastructure** and preserve our fragile **Natural Systems and Agricultural** resources. The plan provides for steps to move toward resilience and reduce emissions through exploring alternatives and decreasing our use of **Energy and Fuel**. The plan builds upon our strength as effective emergency responders and integrates climate change hazards in **Risk Reduction and Emergency Management** planning. Finally, the Regional Climate Action Plan creates a common vocabulary for **Outreach and Public Policy** development to effectively communicate the steps from risk to resilience with the general public, voters, elected officials and decision makers in Southeast Florida, the state and the nation.

The specific recommendations put forth in this plan were developed through a collaborative process involving nearly 100 subject matter experts from a host of professions representing the

*Southeast Florida is considered one of the most vulnerable areas to climate change and sea level rise.*

public and private sectors, area universities, and not-for-profit organizations. These stakeholders brought to the table the knowledge of their “craft” as well as information on successful initiatives already underway locally or in other communities. Many of the recommendations build upon best practices sprinkled throughout our region, such as regional collaboration on transportation planning and land use criteria that foster walkable and healthy communities. Others delve into “new” frontiers in calling for the integration of climate change into planning and decision-making processes in ways that no local government has yet implemented.

The overall objective was and remains to integrate climate adaptation and mitigation into existing decision-making systems and to develop a plan that can be implemented through existing local and regional agencies, processes and organizations. It is in that spirit that this plan provides the common integrated framework for a stronger and more resilient Southeast Florida starting today and for tomorrow.

The 110 action items detailed in the plan’s seven goal areas are to be accomplished over the next five years with annual reports to mark progress. The policy recommendations will be implemented through several approaches including:

- **existing legal structures**, planning and decision-making processes;
- the development of **new policy guiding documents** by local and regional governing bodies; the development of **operational guidance documents**;
- the development of **consistent goals and progress indicators** throughout the various governments in the region;
- a coordinated **multi-disciplinary outreach and education program**; and
- processes for **focused and prioritized investments**



Every organization in the region has a role to play in making Southeast Florida a resilient and sustainable community of communities.

## II. Introduction and Background: Southeast Florida Climate Change Compact Guidance for Regional Policy and Planning

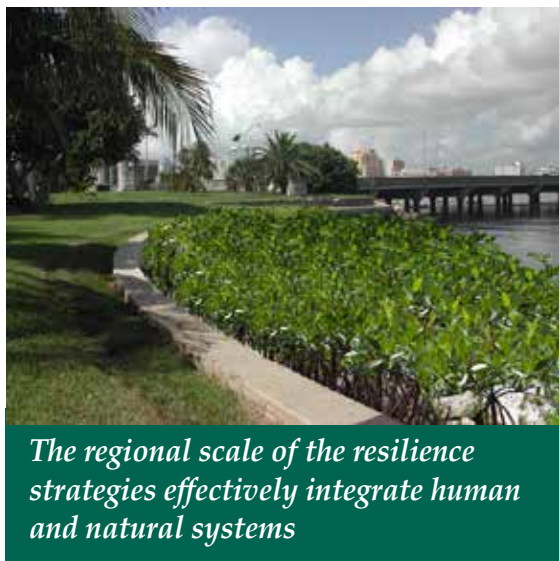
Southeast Florida is considered one of the most vulnerable areas to climate change and sea level rise. In the spring of 2009, several Southeast Florida counties and cities were making the rounds in the halls of Congress to advocate for climate policy. A great deal of work had been invested individually by each jurisdiction; however, each had slightly different baseline emissions figures at different points of time and different sea level rise planning scenarios. The need for regional coordination became quite evident. With 5.6 million residents within the geographic boundaries of the four counties as of the 2010 Census, exceeding the population of 30 states and representing 30 percent of Florida's population and Gross Domestic Product, there is an obvious and unique strength in the region's size and in numbers. That realization paved the way for a unique arrangement – the Compact – a voluntary and cooperative partnership among governing bodies to tackle one of, if not the most important issue facing our generation. This targeted and focused collaborative is the vision and framework for regional resilience. It respects the diversity of the region and the autonomy of the many governing bodies.

The Compact began with a commitment among elected officials representing each of the four counties to return to Southeast Florida and to coordinate in the hosting of a regional climate summit. The Summit would serve as a platform for broader discussion among county and municipal elected officials and the community as to the pressures and challenges that climate change poses for Southeast Florida with a call for unified action. Just four months later, their vision began to take shape when the four County Commissions jointly held the 2009 Regional Climate Leadership Summit. This first Regional Summit led to the ratification of the Southeast Florida Regional Climate Change Compact by January 2010, with unanimous votes within each County Commission (Appendix A). Since adoption, the Counties have assigned existing staff resources to support implementation of the Compact under the direction of a Compact Staff Steering Committee.

The Compact Staff Steering Committee is comprised of two staff members from each county, one municipal representative from each county and a non-voting member from the South Florida Water Management District who was invited to participate. Municipal members represent the cities of Fort Lauderdale, Key West and Boynton Beach. The Compact Staff Steering Committee is a small, core group of professional staff engaged in this process since 2009.

The Compact commitments include:

- Joint legislative policy development;
- Development of a regional greenhouse gas (GHG) baseline;
- Development of regionally consistent sea level rise projections for the coming decades;
- Development of Preliminary Inundation Mapping;
- Development of a Regional Climate Action Plan; and
- Coordination of Annual Leadership Summits.



*The regional scale of the resilience strategies effectively integrate human and natural systems*

The Compact paved the way for early work in 2010 to develop the unified regional baseline and sea level rise planning scenarios. Summaries of these work products are provided in Section IV. This early work served as the foundation for the development of this regional framework through three Work Groups: Built Environment, Transportation, and Land and Natural Systems. These Work Groups were chaired by Staff Steering Committee members and expanded to include local and regional experts from the public and private sectors and academia.

### III. Compact Awards and Recognitions

Since adoption, the Compact has won recognition through awards from ICLEI and the National Association of Counties, a requested white paper from the White House Domestic Policy Council, a request to host a listening session for the White House Council on Environmental Quality's (CEQ) Interagency Adaptation Task Force, and specific references within the Task Force's Final Report to the president. Subsequent federal agency engagement in the Compact has been highlighted in CEQ reports to the president, including the most recent Task Force report submitted in October 2011.

## IV. Compact Work Completed

The adoption of the Compact initiated an ambitious schedule requiring the completion of a robust body of work leading to this Regional Climate Action Plan. Since Compact adoption in January 2010, the four Compact Counties have completed the following:

### a. Policy and Advocacy

Sections 1 – 4 of the Compact Resolution commit the Compact Counties to develop joint climate and energy-related policy positions and advocacy strategies to influence state and federal legislation. Specifically, provisions of the Compact call for urging Congress to pass legislation that: recognizes the unique vulnerabilities of Southeast Florida to climate change impacts, especially sea level rise; allocates federal climate change funding based on vulnerabilities; designates areas of Southeast Florida as uniquely vulnerable and of federal interest for the purpose of securing enhanced levels of federal participation in regional adaptation projects; and supports strengthening policies relating to global climate change.

Since the ratification of the Compact, the Compact partners have advanced policy and advocacy goals through joint positions, resolutions, letters and funding proposals and advocacy in Tallahassee and Washington, D.C. In addition, during the 111<sup>th</sup> and 112<sup>th</sup> sessions of the United States Congress, the Compact partners collaborated in the submittal of a *joint Climate Adaptation Pilot Project Proposal*, a funding request to support regional hydrologic modeling needed to guide adaptation planning in response to projected sea level rise. In May 2010, elected officials and other leaders representing the Compact Counties jointly advocated in Washington, D.C. to highlight the region's vulnerabilities and needs related to climate change impacts, to seek support for greater recognition of adaptation strategies in federal climate policies and for the appropriations of projects such as the regional Pilot Project.

On June 24, 2010, in response to the Deepwater Horizon Oil Spill that threatened the region's environment and economy, the Compact Counties conducted a well-attended conference calling for comprehensive federal energy policy and protection of Florida's state and federal waters from the impact of oil drilling. In concert with local municipalities and Leagues of Cities, the event produced the Southeast Florida Response to Deepwater Horizon Oil Spill Letter to President Obama and resolutions in support for comprehensive climate legislation, restoration of damages due to the oil spill and for a ban on oil drilling within Florida's Territorial Waters.

As a centerpiece of the Compact Counties' commitment to developing regional legislative policies and advocacy strategies, the Compact Counties adopted the 2011 and 2012 *Southeast Florida State and Federal Energy and Climate Legislative Programs* and utilized these programs as the basis of joint advocacy to Congress and the Florida Legislature. The 2011/12 State and Federal Legislative Programs include support for:

- the Southeast Florida Climate Adaptation Pilot Project Proposal;
- providing a definition of "Adaptation Action Areas (AAA)" in state law;
- greater recognition of adaptation as a critical climate strategy;
- adopting a State Renewable Energy Portfolio Standard of 20 percent renewable energy by 2020;
- federal legislation to create and fund new infrastructure programs to assist local governments in adapting to the impacts of sea level rise;
- federal recognition of AAA's for the purpose of funding infrastructure vulnerable to sea level rise
- removing federal barriers to Property Assessed Clean Energy (PACE) and PACE-like programs, posed by the Federal Housing Finance Agency, to encourage energy efficiency and renewable energy improvements for residential homes and commercial buildings; and
- opposing oil drilling in federal waters on Florida's Outer Continental Shelf and the Everglades.

*The plan is a critical milestone of the Compact ...*

*... a vision and framework for regional resilience.*



*The four County Commissions jointly held the first Regional Climate Leadership Summit in 2009.*

Utilizing the Compact Counties' Legislative Programs as guidance during the 2011 Florida Legislative Session, the Compact Counties were successful in helping to amend state law to reflect priority policy goals. The regional partners helped draft and led efforts to provide for a designation of "Adaptation Action Areas"

in Florida's growth management laws, thus creating a new tool for local governments to identify areas vulnerable to coastal flooding resulting from the impacts of sea level rise and to prioritize infrastructure improvements and funding for improved resilience. Immediately following changes to



state law, a Members Letter was signed by several members of Florida's Congressional Delegation requesting support for defining AAA in federal law. Subsequent to the Members Letter, the Compact Counties' lobbyists and Delegation Members have requested the inclusion of language enabling at-risk, multi county regions impacted by sea level rise to qualify for 2012 Energy and Water Appropriations. During the 2012 Florida Legislative Session the Compact Counties were successful in helping to amend the Florida Energy Act to provide for commercial buildings to qualify for energy efficiency program funding through the Local Option Sales Tax.

The Regional Climate Action Plan contains actionable recommendations related to public policy and outreach in recognition of the fact that a continued commitment to collaborate with local, state and federal policy makers, as well as the non-profit and private sectors, is fundamental to long-term success of the Compact. Additionally, the continued and enhanced role of policy advocacy through regional collaboration, especially during tumultuous economic and political times, are important to ensure that current efforts are not undermined and the Compact Counties' future efforts related to sustainability are achieved.

## **b. A Baseline of Greenhouse Gas Emissions for Southeast Florida**

Prior to the Compact, many jurisdictions within Southeast Florida had completed emission inventories using a variety of baseline years. The Compact called for the identification and quantification of Greenhouse Gas (GHG) emissions across Southeast Florida "with a particular focus on emissions from inter-county travel and commerce." Consistent with this charge, staff estimated GHG emissions resulting from an inventory of select sectors – transportation and the built environment divided into residential, commercial and industrial subsectors – using the ICLEI International Local Government Emissions Analysis Protocol (IEAP) within the ICLEI Clean Air and Climate Protection 2009 (CACP 2009) software. "Non-regional" emissions such as the waste sector (including landfill and wastewater treatment) and local government operations were not included as they were deemed to be primarily under the control of individual jurisdictions. Other sectors such as natural areas and agriculture (including their carbon sequestration or "sink" capacity) were not included here due to lack of local information.

As emissions track closely with economic output and as this analysis was initiated during the most significant economic downturn since the 1930s, staff decided to inventory annual emissions for each year from 2005 through 2009 (five full years) and average the results for each sector over those five years for use as a future baseline. By doing so, the inventory averages contain years of both high growth and contraction. The full Regional Inventory report is included as a supporting document to the Regional Climate Action Plan process.

*The transportation sector is the largest single source of regional emissions.*



*Residential and commercial building are jointly responsible for 54 percent of regional emissions.*

Southeast Florida peaked in total GHG emissions in 2006 and declined in the following three years, consistent with the performance of the national economy during this period (Table 1).

The relative emissions contribution of each County to the aggregated regional emissions reflects population and size.

**Table 1: Regional Emissions by County (MMTCO<sub>2</sub>e)**

| County           | 2005       | 2006       | 2007       | 2008       | 2009       |
|------------------|------------|------------|------------|------------|------------|
| Broward          | 22,655,421 | 22,657,880 | 21,921,832 | 21,216,712 | 20,810,719 |
| Miami-Dade       | 28,715,847 | 29,058,677 | 27,832,307 | 27,057,988 | 26,859,326 |
| Monroe           | 1,504,047  | 1,532,500  | 1,465,634  | 1,408,288  | 1,417,206  |
| Palm Beach       | 16,588,536 | 16,658,369 | 15,920,070 | 15,785,752 | 15,675,174 |
| Regional Sources | 254,537    | 250,984    | 237,691    | 222,113    | 155,359    |
| Totals           | 69,718,390 | 70,158,412 | 67,377,537 | 65,690,854 | 64,917,785 |

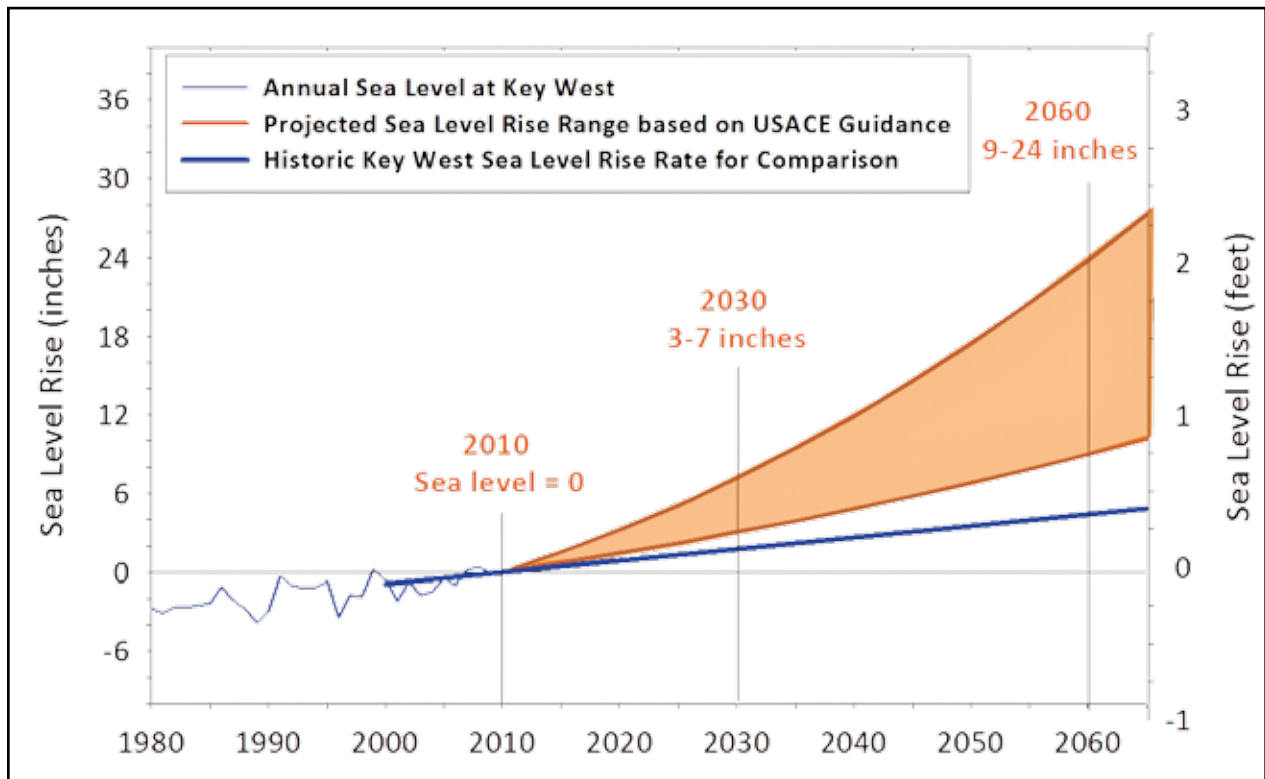
Regional emissions, across all sectors examined, were approximately 64.9 million metric tonnes of carbon dioxide equivalent (MMTCO<sub>2</sub>e) in 2009, down from 69.7 MMTCO<sub>2</sub>e in 2005. The five-year average of emissions (67.6 MMTCO<sub>2</sub>e) shows that the transportation sector is the largest single source of regional emissions. The Residential and Commercial buildings sectors jointly contribute 54 percent to regional emission (Table 2).

**Table 2: Regional Emissions by Sector (MMTCO<sub>2</sub>e)**

| Sector         | 2005       | 2006       | 2007       | 2008       | 2009       | Five Yr Avg |
|----------------|------------|------------|------------|------------|------------|-------------|
| Residential    | 19,963,638 | 19,989,441 | 18,685,833 | 18,186,886 | 18,237,990 | 19,012,757  |
| Commercial     | 17,884,892 | 18,212,352 | 17,356,620 | 17,314,930 | 17,083,809 | 17,570,521  |
| Industrial     | 1,075,979  | 1,103,572  | 961,883    | 888,111    | 811,016    | 968,112     |
| Transportation | 30,793,879 | 30,853,046 | 30,373,200 | 29,300,926 | 28,784,969 | 30,021,204  |
| Totals         | 69,718,390 | 70,158,412 | 67,377,537 | 65,690,854 | 64,917,785 | 67,572,596  |



### c. Unified Sea Level Rise Projection



**Figure 1: Unified Southeast Florida Sea Level Rise Projection for Regional Planning Purposes.** This projection uses historic tidal information from Key West and was calculated by Kristopher Esterson from the United States Army Corps of Engineers using USACE Guidance (USACE 2009) intermediate and high curves to represent the lower and upper bound for projected sea level rise in Southeast Florida. Sea level measured in Key West over the past several decades is shown. The rate of sea level rise from Key West over the period of 1913 to 1999 is extrapolated to show how the historic rate compares to projected rates. Methods are described in a supporting document, “A Unified Sea Level Rise Projection for Southeast Florida” available online at: [southeastfloridacclimatecompact.org](http://southeastfloridacclimatecompact.org).

At the first Regional Climate Leadership Summit, the local diversity in sea level rise (SLR) projections was highlighted as a concern, and a barrier, to achieving regionally consistent adaptation policies and demonstrating a coordinated local effort to higher decision-making levels. Following the summit, the Compact Staff Steering Committee recognized the critical need to unify the existing local SLR projections to create a single regional SLR projection. Key participants in developing the existing projections and other local scientists specializing in the areas of sea level rise and climate change were invited to participate as the Regional Climate Change Compact Technical Ad hoc Work Group (Work Group). Their objective was to work toward developing a unified SLR projection for the Southeast Florida region for use by the Compact Counties and partners for planning purposes to aid in understanding potential vulnerabilities and to provide a basis for outlining adaptation strategies for the region.

Through a series of facilitated discussions, the Work Group reviewed the existing projections and the current scientific literature related to SLR with particular emphasis on the impact of accelerating ice melt on projections. The Work Group recommended that the SLR projection be based on the United States Army Corp of Engineers (USACE) July 2009 Guidance Document until more definitive information on future SLR is available. The projection uses Key West tidal data from 1913-1999 as the foundation of the calculation and references the year 2010 as the starting date of the projection. Two key planning horizons are highlighted: 2030 when SLR is projected to be 3-7 inches and 2060 when SLR is projected to be 9-24 inches. Based on the projection, a SLR of one foot is projected to occur between 2040 and 2070 with sea level continuing to rise into the future. Due to the rapidly changing body of scientific literature on this topic, the Work Group recommended that the projection be reviewed and possibly revised four years from final approval by the Compact Staff Steering Committee and after the release of United Nations Intergovernmental Panel on Climate Change Fifth Assessment Report. “A Unified Sea Level Rise Projection for Southeast Florida” White Paper is available as a supporting document to this Regional Climate Action Plan.

*Mapping different SLR inundation scenarios helps to identify areas at potential risk and aids in planning for adaptation strategies.*

#### **d. Inundation Mapping and Vulnerability Assessment of Areas at Risk by Sea Level Rise**

Southeast Florida is highly vulnerable to SLR due to its peninsular geography and low topography. Mapping different SLR inundation scenarios helps to identify areas at potential risk and aids in planning for adaptation strategies. The Compact Inundation Mapping and Vulnerability Assessment Work Group was formed to perform a regional vulnerability assessment. Geographic Information System (GIS)



practitioners, representing the Compact Counties as well as the South Florida Water Management District (SFWMD), local universities and federal agencies, worked with National Oceanographic and Atmospheric Administration (NOAA) Coastal Services Center (CSC) experts to understand inundation mapping methodologies, define the local challenges, review available topographic

source data and create a consensus set of methods and criteria for inundation mapping. Additional discussions, surveys and workshops were used to develop planning parameters that would be part of the regional SLR vulnerability assessment. Using these commonly agreed-to parameters and data sources, the SFWMD produced inundation layers to represent areas potentially vulnerable to one-, two- and three-foot SLR scenarios. These layers were used by each of the four Compact Counties to perform a vulnerability assessment for their jurisdiction. See the supporting publication for the County level assessments and detailed methods for inundation mapping and the vulnerability analyses.

*This understanding of a likely future allows us to take action now to protect assets and invest wisely.*

All of the Compact Counties are vulnerable to SLR. However, the degree and extent of potential impacts vary across the region due to differences in land elevation and geomorphology. The southernmost counties are expected to experience the greatest direct impacts, with lessening impacts as one travels northward. Nearly 80 percent of the lands potentially affected regionally in the one-foot scenario are conservation lands, especially coastal wetlands. Low lying natural systems made up of buttonwood, mangrove, scrub mangrove, and herbaceous coastal saline and freshwater wetlands are significantly impacted in all SLR scenarios. The upper estimate of current taxable property values in Monroe, Broward, and Palm Beach Counties vulnerable in the one-foot scenario is \$4 billion with values rising to more than \$31 billion at the three-foot scenario. The greater values reflected in the financial impacts are coastal residential properties with ocean access and high taxable value.

In terms of the critical infrastructure reviewed, projected inundation is often confined to marginal areas of the properties or impacting existing drainage infrastructure on site. This is generally true for the region's ports, airports, schools, landfills and hospitals. Monroe County is the exception with predicted building and infrastructure damage to these critical resources especially at the two

*Taxable property value vulnerable in the one-foot SLR scenario is \$4 billion ...*



*...with values rising to more than \$31 billion at the three-foot SLR scenario.*

and three-foot SLR scenarios. Three of Monroe's four hospitals, 65 percent of schools and 71 percent of emergency shelters are located on property at elevations below sea level at the one-foot scenario. Power plant properties in Miami-Dade and Broward as well as energy transmission facilities in Monroe begin to become inundated at the one-foot scenario. While railroads are negligibly impacted, more than 81 miles of roadway from Miami-Dade through Palm Beach are impacted at the one-foot scenario, increasing to more than 893 miles at the three-foot scenario.

The intent of the GIS-based analysis conducted by the Compact Work Group was to provide a preliminary assessment of sea level rise vulnerabilities for regional planning and policymaking purposes. This analysis did not include other possible impacts associated with sea level rise that require more complex modeling efforts, or indirect impacts, such as delineating what properties may become less accessible due to inundated roadways. Despite these limitations, the GIS-based vulnerability assessment conducted by the Compact Work Group serves to identify areas of potential concern for regional planning of adaptation strategies. It also highlights the need for continued mitigation of greenhouse gas emissions as a means to reduce future sea level rise impacts.

To prepare Southeast Florida for the likely impacts of sea level rise estimated by the vulnerability assessment, cooperation is vital, not only among the Compact Counties, but also among the municipalities, local, regional, state and federal agencies serving the region. Strengthening this regional effort will be critical in order to coordinate public policies and adaptation measures that ensure the region's sustainability and economic growth

## **V. Southeast Florida Regional Climate Action Plan Planning Process**

Members of the Compact Staff Steering Committee and representatives of numerous federal, state, and county agency partners met in February 2011 for a workshop to review the work completed to date and plan a course of action going forward. Workshop participants brainstormed issues including the scope of the Regional Climate Action Plan, criteria to select priority issues, defining regional versus local efforts, areas of expertise needed in issue specific work groups and how best to separate issue areas to be examined into logical, workable groupings. Also discussed were the timeline for the planning process and how to incorporate feedback from the Compact Staff Steering Committee and other stakeholders.

The Compact Staff Steering Committee organized three work groups to develop specific recommendations for reducing GHG emissions and building climate resilience across the region.

The three work groups, **Built Environment, Transportation, and Land and Natural Systems** were designed to bring local experts with differing work experiences and areas of responsibility together to share knowledge and expertise. Each work group consisted of more than 30 individuals from all parts of the four-county region, listed in Appendix C. Work group participants included representatives of academia, non-profits, the private sector and all levels of government. After several work sessions, surveys and much correspondence, draft recommendations were presented to the Compact Staff Steering Committee at a July 2011 workshop. After review and comment, the Compact Staff Steering Committee provided guidance to the three work groups in finalizing the strategies to be included in the Regional Climate Action Plan and convened a “Super Committee” to address three cross-cutting issues that emerged separately from the work groups. The full extent of recommendations from each work group is available as a supporting publication.

*Every organization in the region has a role to play in making Southeast Florida a resilient and sustainable community of communities.*

## Structure of the Regional Climate Action Plan

To further review, consolidate, and categorize the numerous recommendations, the Super Committee was created consisting of key representatives from each Work Group, the Work Group chairs, and representative County staff. The Super Committee worked to consolidate the recommendations into seven categories, including:

- Sustainable Communities and Transportation Planning
- Water Supply, Management and Infrastructure
- Natural Systems
- Agriculture
- Energy and Fuel
- Risk Reduction and Emergency Management and
- Outreach and Public Policy

The definition of each category and the recommendations are detailed as the Regional Climate Action Plan.

The draft Regional Climate Action Plan was released at the third annual Regional Climate Leadership Summit held in Key Largo on December 8 and 9, 2011. The Compact Staff Steering Committee aggressively sought public input and feedback from December through March 2012.



During this time, many public presentations on the draft plan and the Regional Compact were delivered throughout the region. Officially, 105 distinct comments were received through the Compact website from 91 individuals. All comments were reviewed by the Compact Staff Steering Committee and the Work Group Chairs. Since many comments were focused on the details of implementation, those thoughts and ideas are captured in the Implementation Guide that is published as a companion resource to the Regional Climate Action Plan. This public comment period resulted in a more robust regional document.

## **RCAP ... Regional and Municipal Government Collaboration and Shared Implementation**

The Southeast Florida Regional Climate Change Compact emerged in 2009 as a collaborative venture among Palm Beach, Broward, Miami-Dade and Monroe Counties and as such, served as the impetus for creating a common framework for climate change mitigation and adaptation strategies throughout the Southeast Florida region. This initial effort for the Compact Counties to collaborate on a regional scale, proved to be an important first step in gaining public and political support required for the advancement of this comprehensive planning initiative. Early on, municipal government engagement and commitment was also recognized as critically important to the success of the Compact.

There are more than 100 local city governments in the region, each at varying stages of climate mitigation and adaptation planning and implementation. To formally begin collaborative efforts among local governments, the Compact Counties



met jointly with municipal government representatives at the Second Annual Climate Leadership Summit in 2010. More recently, the Compact Staff Steering Committee membership was expanded with municipal representation to ensure involvement of cities in the drafting of the Regional Climate Action Plan. Successful implementation of the Regional Climate Action Plan strategies requires this continued collaboration.

In the forthcoming years, the Compact Counties expect to build coalitions with more municipalities, the various Leagues of Cities, special districts and other governmental entities, including the Treasure Coast counties participating in the Seven50 Sustainable Communities Initiative.



The Compact Counties and municipal partners are committed to the implementation of the Regional Climate Action Plan. Of course, implementation strategies must be sensitive to the different governance structures of counties and municipalities. Because of the variances in government structures, management policies, land use authorities, charters (where present), and the political environments of member counties and municipalities, implementation is expected to take on different forms. This Plan should be viewed as a framework to help guide policies and projects and implementation must be flexible to address specific local conditions.

It is also important to emphasize that the Regional Climate Action Plan does not provide a mandate for any county or municipal actions, but rather serves as a living document with options that each regional or local government may adopt and utilize based on their interests and vision for the future. Over time, this document will be enhanced as more data becomes available, scientific projections are refined, and best management practices are developed and tested.

The success of the planning efforts thus far is a testament to the political leadership and staff dedication to Southeast Florida. We recognize that by combining our efforts and resources, we are in a better position moving forward. The Compact is at an important turning point. As each partner continues to implement different initiatives, at its own pace and within the context of each individual entity, these individual steps will lead to collective results for a more resilient region. Join us, no step is too big or too small.

## VI. Regional Plan Recommendations

The following recommendations are the result of much labor by many individuals and organizations dedicated to a more sustainable and resilient Southeast Florida. The 110 actionable recommendations presented here form the core of Southeast Florida's first Regional Climate Action Plan. These measures draw from and build upon the experience of each partner gained prior to regional collaboration. Some, therefore, are familiar requiring only additional partners for differing scales of implementation. Others are new and designed specifically to address the challenges that become evident through a regional perspective. The Compact Staff Steering Committee has produced a companion document, titled the *Regional Climate Action Plan Implementation Guide*, to provide further insight and guidance on how each of these recommendations can be put to work for Southeast Florida. The Regional Climate Action Plan Implementation Guide is available online at: [southeastfloridaclimatecompact.org/](https://southeastfloridaclimatecompact.org/).

## Sustainable Communities and Transportation Planning

With the establishment of a Unified SLR Projection and the Preliminary Vulnerability Analysis, the picture of the likely future of our region is coming into focus. While the specific conditions at a given point in the future are impossible to predict, the range of potential future conditions has been defined based upon the best available science which includes an agreed upon level of uncertainty. This understanding of a likely future allows us to take action now to protect assets and invest wisely. As the science, monitoring, and modeling of impacts continue to be refined, this area of the plan recommends actions to integrate climate change consideration into existing and future policy decision making processes and municipal and county Comprehensive Plans with the goal to achieve resilience, reduce risk and further greenhouse gas emissions reductions.

As one of many tools available in the comprehensive planning process, this section includes several recommendations addressing the designation and implementation of Adaptation Action Areas which are expected to aid in focusing technical assistance and funding opportunities to areas most vulnerable to the impacts of sea level rise and coastal flooding. In 2011, the Florida Legislature amended state law to provide for Adaptation Action Areas as an optional designation in local comprehensive plans for those identified areas experiencing coastal flooding due to extreme high tides and storm surge and the related impacts of sea level rise. The law also provides for the development of adaptation policies and will maximize funding opportunities for infrastructure needs associated with Adaptation Action Areas. Subsequent to recent changes to state law, members of Congress have since requested the definition of Adaptation Action Areas in federal law to provide for appropriations for adaptation planning and infrastructure needs in designated areas. It is realistic to believe that future funding opportunities will become available through federal and state appropriations and grants for Adaptation Action Areas or areas similarly designated for adaptation planning.



## Sustainable Communities

***GOAL: Reduce financial and physical losses in our building stock by reshaping where and how we build.***

SP-1 Support implementation of the Regional Climate Action Plan by including

recommendations from the Plan into existing land use and policy decisions and related elements of the municipal and county Comprehensive Plans, as appropriate; and recognize the Plan as a basis for the development of new goals, objectives and policies through the appropriate local government Comprehensive Plans.

- SP-2 Develop policies, strategies and standards that will serve as guidance for climate change related planning efforts. Municipal and county planning authorities are encouraged to develop policies to improve resilience to coastal and inland flooding, salt water intrusion, and other related impacts of climate change and sea level rise in their Comprehensive Plans, Sustainability Action Plans, Vision Plans, Stormwater Master Plans, Transit Development Plans, Long Range Transportation Plans, Adaptation Action Area Plans, Climate Change Plans and other green planning efforts.
- SP-3 Incorporate “Adaption Action Area” definition (as provided for in Florida law) into municipal and/or county Comprehensive Plans, to provide a means to identify those areas deemed most vulnerable to sea level rise and other climate change impacts including but not limited to extreme high tides, heavy local rain events, and storm surge for the purpose of prioritized funding and adaptation planning.
- SP-4 Develop criteria in collaboration with municipal and county planning authorities for the purpose of defining Adaptation Action Areas as well as other areas requiring adaptation improvements related to coastal flooding and sea level rise that may include, but not be limited to:
- Areas below, at, or near mean higher high water;
  - Areas which have a hydrological connection to coastal waters;
  - Areas designated as evacuation zones for storm surge; and/or
  - Other areas impacted by climate related drainage/flood control issues.



- SP-5 Conduct new or utilize existing vulnerability analysis and other technical tools as they are developed as a means for identifying Adaptation Action Areas as well as other areas requiring adaptation improvements related to coastal flooding and sea level rise, to provide guidance for adaptation planning efforts in areas especially at risk to sea level rise, tidal flooding and other related impacts of climate change.
- SP-6 Develop policies, as provided for in Florida law and in collaboration with the appropriate municipal and county planning authorities, related to areas designated as Adaptation Action Areas or similarly vulnerable areas to improve resilience to coastal flooding, sea level rise and other climate related vulnerabilities and provide guidance for other adaptation planning efforts.
- SP-7 Develop sea level rise scenario maps to be considered for inclusion in appropriate Comprehensive Plans and/or regional planning documents as determined by the appropriate local government to guide municipal and county government climate adaptation planning efforts and continue to update regional and local planning efforts as more data becomes available and scientific projections are refined.
- SP-8 Identify locations within Adaptation Action Areas or similarly vulnerable areas where targeted infrastructure improvements, new infrastructure, or modified land use and/or development practices could reduce vulnerability and/or improve community resilience.
- SP-9 Coordinate regionally across municipalities and county planning authorities on the development of projects and funding proposals to seek prioritized funding for identified infrastructure needs and specific adaptation improvements required within Adaptation Action Area or other related adaptation planning areas.
- SP-10 Work with appropriate local, regional and state authorities to revise building codes and land development regulations to discourage new development or post-disaster redevelopment in vulnerable areas to reduce future risk and economic losses associated with sea level rise and flooding. In these areas, require vulnerability reduction measures for all new construction, redevelopment and infrastructure such as additional hardening, higher floor elevations or incorporation of natural infrastructure for increased resilience.
- SP-11 Identify within Adaptation Action Areas and similarly impacted areas populations and communities most vulnerable or of special concern for the purpose of ensuring the

proper consideration of individual needs and resources as part of local and regional planning activities.

- SP-12 Develop new community flood maps reflective of a 100-year storm event under future sea level rise scenarios and use this information, in conjunction with similarly updated storm surge models for revising required elevations for new and redevelopment, and in the permitting/licensing of transportation projects, water management systems, and public infrastructure.
- SP-13 Designate or otherwise recognize “Restoration Areas” to identify undeveloped areas that are vulnerable to climate change impacts for the purpose of environmental restoration, dune restoration, agriculture, conservation of natural resources or recreational open space, or as stormwater retention areas. Local governments and appropriate regional planning authorities should prioritize land acquisition in these areas. These areas could also be established or acquired through mitigation or transfer-of-development rights initiatives.
- SP-14 Designate or otherwise recognize “Growth Areas” as areas outside of Adaptation Action Areas, or other areas subject to adaptation planning efforts, where growth is encouraged due to higher topographic elevation and the presence of existing infrastructure, such as transportation and water and sewer infrastructure. Growth Areas should be developed with Urban Design guidelines that address character of urban place and provide a high quality pedestrian experience through landscaping and the creation of public space.
- SP-15 Modify or develop new design standards for transportation infrastructure located in identified vulnerable areas to include environmentally supportive road materials, bridge design, elevation, and stormwater management. Include different pitches combined with stormwater design to effectively remove water from the roadway; explore roadway materials that may be utilized in road construction that are more tolerant of extended periods of extreme temperatures.
- SP-16 Develop policies to address new transportation infrastructure development in light of anticipated future climate impacts, such as consideration of future floodplain conditions and vulnerable areas which could require the rerouting of roads because of potential flooding and related damage.



- SP-17 Analyze potential blighted sites and develop an approach for converting underutilized or unused properties and structures, including properties in financial distress, into community gardens or farmers' markets. (i.e., Redfields to Greenfields)

## Transportation Planning



*More than 100 entities in the four-county region exercise governance over transportation planning, operation, and investment decisions.*

The transportation sector contributes 45 percent of the region's greenhouse gas emissions, with the majority of trips taken for family and personal purposes in single occupancy vehicles. Reducing vehicle miles traveled (VMT), which reduces emissions, can be achieved by shifting trips taken in the personal vehicle to walking, biking, and public transportation, and shortening or avoiding trips altogether through community design and sustainable development strategies. Recent studies demonstrate the significant impact this approach

can have on avoiding greenhouse gas emissions - estimating that the five "Ds" of compact development – density, diversity, design, destination and distance to transit – are expected to reduce VMT by 12 to 18 percent (Urban Land Institute). Clearly, the success of this reduction is dependent on the extent and timing of implementation. While recommendations in this area call for increased funding for mobility solutions that achieve a reduction in greenhouse gas emissions and also increase the livability and economic strength of the region by reducing our dependence on the personal vehicle, others focus on more immediate strategic service improvements as well as initiatives to attract individuals who could drive their cars but who choose to ride transit or share a ride because of the conveniences and other benefits represented by these choices.

More than 100 entities in the four-county region, including municipalities, county and state governments, metropolitan planning organizations, and regional planning bodies, exercise governance over transportation planning, operation, and investment decisions. A continued and expanded collaborative approach to these activities will be a cornerstone to implementing these recommendations that not only serve to reduce greenhouse gas emissions but will realize cross-cutting benefits of more livable and desirable communities within our region.

***GOAL: Reduce greenhouse gas emissions by planning, designing, and prioritizing walkable, affordable communities supported by sustainable multimodal transportation options.***



- SP-18 Identify means to effectively engage the multiple public and private sector entities with roles and responsibilities involving the provision and maintenance of transportation infrastructure and the delivery of transportation services in the region, in climate adaptation and mitigation initiatives. Document current and evolving coordination efforts among these entities.
- SP-19 Focus transportation investments and service expansions on projects and strategies contributing to greenhouse gas emissions reductions and enhancing resilience to climate change.
- a. Continue to enhance and implement regionally coordinated transportation planning through the Regional Long Range Transportation Plan (RLRTP). Identify goals and objectives in the RLRTP which, as they are attained, reinforce the desired achievement of greenhouse gas emissions reductions and enhanced resilience to climate change. Articulate the supportive role of these goals and objectives for emissions reductions and climate resilience.
  - b. Give higher investment priority to and advocate for state and federal transportation infrastructure investments, programs and services that will reduce greenhouse gas emissions and enhance resilience and adaptability to climate change. Performance standards for climate and related metrics, such as reduced VMT and increased mode split, should be incorporated in transportation plans and programs. Transportation planning should include performance measures<sup>1</sup> in major decision-making phases such as land use visioning, long range transportation plans, corridor studies, programming, environmental review, and performance monitoring.
  - c. Incorporate evaluation criteria and processes to prioritize projects that meet RLRTP goals and objectives — into local and regional planning and programming processes — with an initial emphasis on evaluation criteria that reduce VMT and increase use of transportation modes other than the personal vehicle. Projects that enhance economic vitality should also be given priority, such as projects and service expansions along transit-oriented corridors and those that improve connections to major airports and seaports.
  - d. Prioritize studies funded through existing programs and other sources addressing effective climate adaptation and mitigation strategies, particularly those addressing barriers to adaptation and assisting in integrating land use and transportation planning.

- e. Improve coordination among economic development, land-use/housing, transportation and water resource planning activities. Review local and regional planning and decision making processes to ensure a complementary approach toward developing and maintaining a transportation network, including for purposes of reducing VMT and providing more transportation choices.
- SP-20 Require that new development and redevelopment in areas with existing and planned multimodal corridors that connect urban and other centers in the region be planned and designed to support walking, biking and transit use.
- SP-21 Support effective planning and implementation of transit oriented developments (TODs)<sup>2</sup>, from both a local and regional scale, in coordination with effective planning and delivery of transit services, particularly transit stations<sup>3</sup>, to maximize ridership.
- a. Recognize that planning for TOD requires consideration of transit and land use issues at the system, corridor and station levels, as well as evaluation of adequate infrastructure such as water and sewer mains.
  - b. Develop policies to streamline approval processes involving TODs.
  - c. Ensure equitable distribution of the benefits of TOD and premium type transit services.
- SP-22 Introduce a new activity-based regional travel demand forecast model to directly simulate individual trip making and mode choice behaviors. Simulations done using the model will allow for robust tests of the effectiveness of policy alternatives.
- SP-23 Consider regional implementation of rapid transit zones to maintain land use control around a station with multiple jurisdictions. Modify local land use plans and ordinances to support compact development patterns, creating more walkable and affordable communities.

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<sup>1</sup>One example of incorporating sustainable transportation performance measures into existing planning processes is: *Environmental Protection Agency's Guide to Sustainable Transportation Performance Measures (EPA 231-K-10-004, August 2011)*.

<sup>2</sup>Transit oriented developments (TODs) are compact moderate to high intensity and density mixed use areas, within one-half mile of transit stations, designed to maximize walking trips and access to transit.

<sup>3</sup>A transit station in this context means one serving a premium type of transit including commuter rail, light rail, express bus service such as the 95 Express Bus, bus rapid transit service (as defined by the Federal Transit Authority), or a station that functions as a local bus hub or transfer station, serving a minimum of three fixed routes operating with headways of 21-30 minutes or less.

*Recommendation:  
Work regionally  
to improve safety  
for pedestrians and  
bicyclists.*

- a. Identity potential future land use map and other comprehensive plan changes at the local level. Also address the subject in regional level plans.
- b. Adopt form-based codes that have physical form, design of buildings and the public realm, and an emphasis on mixed and evolving land uses as organizing principles.
- c. Consider regional implementation of rapid transit zones or other such designations to maintain land use control around transit stations, including ones with multiple jurisdictions.



- SP-24 Consider the adoption of green neighborhood certification programs, such as LEED ND (Neighborhood Development) to guide decision making and development and to provide an incentive for better location, design, and construction of new residential, commercial, and mixed-use developments with the goal of increasing transportation choices while reducing household transportation costs. Incorporate sustainable building and neighborhood ratings or national model green building codes, including but not limited to those defined in Section 255.253(7), Florida Statutes, into municipal codes region-wide.
- SP-25 Adopt or create a green rating system for roads to reduce emissions from construction, maintenance, and agency operations through practices such as using recycled materials, purchasing materials found or manufactured sustainably in the region, and requiring construction contractors to implement emissions reductions practices such as using alternative fueled vehicles and clean diesel practices.
- SP-26 Improve movement and safety for non-motorized modes through the adoption and implementation of best practice models including Complete Streets.
- a. Develop policy, ordinances, guidelines, models and projects to accelerate implementation.

- b. Identify partners and resources to support training and the research into new techniques for transportation design and other professionals.

SP-27 Complete, expand and connect networks of bicycle and pedestrian facilities, including supporting access to transit.

- a. Prioritize implementation of planned bicycle and pedestrian networks. Improve overall coordination of local and regional agency planning and implementation efforts. Evaluate whether these facilities are connected regionally and on a local scale to major employment, education, and recreation centers.
- b. Implement a roadway design project checklist that includes measures of pedestrian, bicycle, and transit (e.g. bus bay) accommodation.
- c. Work regionally to improve safety for pedestrians and bicyclists.
- d. Consider regional adoption of Transit, Pedestrian, and Biking programs that aim to improve access to transit.
- e. Develop policies to increase designated bike parking facilities at office and retail developments.



*Recommendation: Partner to implement a Virtual Freight Network as part of the region's comprehensive Intelligent Transportation System.*

SP-28 Continue to implement strategies aimed at maximizing the efficiency of the existing transportation network by all agencies across the region. Many of these strategies also result in greenhouse gas emissions reductions. There is a need for a toolbox of successful strategies that can be duplicated across the region. Agencies should make an effort to collect information that will allow for evaluation of the effectiveness of a strategy in reducing greenhouse gas emissions. Information collected by implementing agencies should include emissions reductions, fuel reductions, VMT impacts, or other performance measures as appropriate. Information collected should also include steps for implementation, costs, and lessons learned. Among the strategies to consider are use of roundabouts, real time operation of the traffic signal system, traffic signal prioritization and queue jumps for transit, interstate ramp metering, and employment

of a virtual freight network (freight network managed in real time using intelligent transportation systems).

- SP-29 Increase transit ridership by providing premium transit service<sup>4</sup> on targeted regional corridors. Examples of successful routes include the I-95 Express bus service and “The Flyer” route from Miami International Airport to Miami Beach. The goal of these routes is to bring people who might otherwise drive to work (known as “choice riders”) from residential areas to regional centers of employment. Agencies should review levels of service policies and service standards and modify as necessary to prioritize increasing services along corridors with dense land use. Improve quality of service by continuing to monitor and address safety and performance.
- SP-30 Increase the amenities and infrastructure available to transit riders, such as shade, shelters, kiosks utilizing solar power when feasible, and route and real time boarding information.
- SP-31 Provide seamless transitions to increase the use of low carbon modes for the movement of people and freight in the region.
- a. Improve connections among Tri-Rail and county transit service, municipal trolley and community shuttle bus services which may include realignment of routes. District circulators, such as the Metro Mover in downtown Miami, which connects to Metro Rail, provide the last leg of a commute for transit riders and should have high frequency and ease of transfer.
  - b. Implement seamless regional transit fare and transfer media (traditional or virtual) across transit services in the region while improving walking and biking access to transit.
  - c. Develop planning strategies to address planning for the “First and Last Mile” of transit trips, which act as barriers for commuters who could potentially take transit but whose starting point or final destination cannot be conveniently accessed from

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<sup>4</sup> The term premium transit service in this context means rail, express bus service, or the Federal Transit Authority definition of Bus Rapid Transit service, which are routes predominantly on fixed guideways or high frequency bus service with the following elements: substantial transit stations, traffic signal priority or preemption, low-floor vehicles or level platform boarding, and separate branding of the service. High-frequency service is defined as 10-minute peak and 15-minute off-peak headways for at least 14 hours of service operations per day.

the nearest transit stop/station due to distance, terrain (street patterns), or real or perceived safety issues (traffic, crime).

- d. Partner to implement a Virtual Freight Network as part of the region's comprehensive Intelligent Transportation System/Transportation System Management and Operations Programs. Establish a software application to provide "load matching" for shippers and truckers to alleviate "deadheading" of empty trucks traveling back to destination.

- e. Incorporate climate adaptation strategies and greenhouse gas emissions inventories into Seaport and Airport Master Plans and Regional Freight Plans. Plans should address the critical last mile to and from major seaports and airports in part by providing comprehensive plan land use designations, policies, and standards that protect that function of roadway segments connecting seaports and airports (hubs) to corridors, such as interstates.



*Recommendation: Increase transit ridership by providing premium transit service on targeted regional corridors.*

- f. Establish performance measures including VMT reduction and emissions reductions monitoring for freight projects such as ship to rail projects which remove drayage truck operations<sup>5</sup>.
- g. Support clustering of distribution facilities to promote intermodal centers and economic development.

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<sup>5</sup> "Drayage truck operations" refer to truck container pickup from or delivery to a seaport terminal with both the trip origin and destination in the same urban area.



- SP-32 Use and expand Transportation Demand Management (TDM) strategies, which reduce peak hour and single-occupant vehicle travel.
- a. Vanpool and Carpool Programs - Work with MPOs, South Florida Commuter Services and South Florida Vanpool to identify and pursue opportunities to more fully utilize and expand these programs.
  - b. Car and Bike Sharing Programs - Work with companies providing these services and strategic partners (universities, municipalities, large employers, etc.) to establish zip car, bike sharing and personal vehicle sharing programs.
  - c. Employee Benefits – Encourage sharing of information on and use of employee benefits that support use of walking, biking and transit modes for work commutes (e.g., pre-tax benefits and Emergency Ride Home program).
  - d. Commute Trip Reduction Programs - Local governments should promote participation in programs such as the EPA Commuter Choice Program and explore the adoption of commute trip reduction ordinances.
- SP-33 Coordinate initiatives with those of the seven-county Southeast Florida Prosperity Plan, known as Seven50, to maximize the opportunities presented as Seven50 is developed (e.g., sharing data and analyses; participating in alternative future scenario planning; engaging a myriad of public, private and civic partners) and actively engage in Seven50 implementation efforts, designed to address the following Livability Principles:
- Provide more transportation choices
  - Promote equitable, affordable housing
  - Enhance economic competitiveness
  - Support existing communities
  - Coordinate policies and leverage investment;
  - Value communities and neighborhoods and
  - Enhance community resilience to the impacts of Climate Change

## Water Supply, Management and Infrastructure

Climate change presents serious challenges for water managers with impacts on the quality and abundance of water supplies, water and wastewater infrastructure, and drainage and flood control operations. An effective response will require the coordinated efforts of governmental agencies and service providers and a holistic approach that treats water supply, disposal and management as integrated systems.

In Southeast Florida, climate change is predicted to influence precipitation patterns with both water supply and water management implications. Fewer storm events, drier winter and spring months, and an increase in local evapotranspiration rates (water lost to the atmosphere through evaporation and plant transpiration) will increase the frequency and severity of droughts while less frequent but more intense storms will tax water management systems causing both inland and coastal flooding. Impacts will be compounded by sea level rise with the loss of coastal wellfields due to saltwater intrusion and constraints on water management operations due to increases in groundwater levels and reduced discharge potential at canal water control structures. Addressing the impacts of climate change will require: finding solutions to consistently maintain high quality and adequate water supplies for all local communities, strategies to reduce the cost and energy demands of alternative water supplies, consideration of future conditions with respect to the placement of infrastructure, and investments in new and upgraded infrastructure to maintain essential drainage and flood control operations. Additionally, SLR from climate change is threatening the Florida Everglades, the backbone of our natural resource system, highlighting the urgent need for restoration of the Everglades with improved delivery and distribution of water flow to provide both natural resources and water supply benefits.

Given these challenges, it is essential to identify practical solutions today to help mitigate the impact of climate change on our future water supply. The Regional Climate Action Plan proposes recommendations to provide regionally coordinated water management plans that address

*Climate change presents serious challenges for water managers.*



*It is essential to identify practical solutions today.*

stormwater use and disposal, traditional and alternative water supplies, wastewater disposal and reuse, water conservation measures, and continued support for Everglades restoration efforts.

A unified effort among government, businesses, and consumers is needed to implement near-term solutions and develop long-term strategies to mitigate adverse impacts of climate change on water supplies while developing new sources that add diversity to our water supplies. Efforts will require optimized use of all water resources, with conservation being paramount, along with development of new sources less vulnerable to changing climate conditions. The challenge will be to implement these necessary projects without marked increases in energy consumption, a difficulty that underscores the value of conservation as a priority strategy. Policy and regulatory changes, funding for infrastructure, development of alternative water supplies, and public education will all be necessary in order to make significant progress. The issues are vast and the investments to be great, with effective response requiring the collaboration of the public, financial participation of state and federal governments, and the exploration of new finance strategies.

***GOAL: Advance water management strategies and infrastructure improvements needed to mitigate for adverse impacts of climate change and sea level rise on water supplies, water and wastewater infrastructure, and water management systems.***

- WS-1 Develop local and, where appropriate, regional inventories of existing potable water supply delivery and collection systems, vulnerable wellfields, wastewater collection and/or treatment infrastructure, septic tanks/drainfields, and stormwater drainage and treatment facilities; assess the potential impact from climate change of each component; and develop different climate change scenarios and adaptation strategies for high-risk utilities and/or infrastructure which may require replacement, reinforcement, or relocation to ensure the long-term viability of the system (e.g., modified site, depth, elevation, materials, or connection requirements).
- WS-2 Develop a regional saltwater intrusion baseline and utilize saltwater intrusion models to identify wellfields and underground infrastructure at risk of contamination/infiltration by saltwater with increases in sea level.
- WS-3 Utilize existing and refined inundation maps and stormwater management models to identify areas and infrastructure at increased risk of flooding and tidal inundation with increases in sea level, to be used as a basis for identifying and prioritizing adaptation needs and strategies.

WS-4 Evaluate the impacts of rising sea and groundwater levels on soil storage, infiltration rates and inflow to stormwater and wastewater collection and conveyance systems; consider longer-term influences on water quality; and develop strategies for implementing reclaimed water and



stormwater reuse projects that account for current and future conditions.

WS-5 Develop and apply appropriate hydrologic and hydraulic models to further evaluate the efficacy of existing water management systems and flood control/drainage infrastructure under variable climate conditions. Quantify the capacity and interconnectivity of the surface water control network and develop feasible adaptation strategies.

WS-6 Coordinate with the South Florida Water Management District, Drainage/Water Control Districts, and utilities/public works officials to identify flood control and stormwater management infrastructure already operating below the design capacity. Further examine water control structures to ensure that they can provide for inland or upstream migration of riparian species as freshwater habitats become more saline.

WS-7 Develop Integrated Water Management Plans that present a joint assessment and planning strategy involving local water utilities, wastewater service providers, water managers, and partners to the Southeast Florida Regional Climate Change Compact, for coordinated consideration of stormwater use and disposal, traditional and alternative water supplies, wastewater disposal and reuse, and water conservation measures for use by local leadership to guide planning decisions as well as amendments to applicable codes and regulations.

WS-8 Develop and test water management and drainage system adaptation improvements needed to maintain existing levels of service relating to drainage, flood control, and water supply, and use cost-benefit analyses to prioritize potential improvements.

- WS-9 Incorporate and prioritize preferred climate adaptation improvement projects in capital improvement plans and pursue funding.
- WS-10 Encourage, foster, and support investigative work and scientific research that improves the understanding of local and regional climate change impacts specific to Southeast Florida, including:
- Improved down-scaling of global climate models for representation of precipitation at the regional/local scales
  - Identification and targeting of gaps in monitoring to improve quantification of the hydrologic system and its response to climate change, such as evapotranspiration, groundwater levels, and precipitation, and local sea level
  - Development of risk-based decision support tools and processes for application in analysis of infrastructure design, water resource management, natural systems management, and hazard mitigation alternatives. Tools should provide for consideration of potential economic costs of comparative planning scenarios, management decisions, and infrastructure investments and the evaluation of potential tradeoffs.
- WS-11 Undertake efforts to fill identified data gaps through local program efforts, agency collaborations, and advocacy for additional state/federal resources, as needed.
- WS-12 Foster the development and exchange of new information, methods and technical capabilities to address key questions of concern related to climate variability and sea level rise to support management decisions:
- Assess impacts of observed and predicted climate variability and sea level rise on the frequency, duration, and intensity of flooding as a result of extreme tidal excursions, storm surge, and 100-year storm events, and where impacts are likely to be greatest.
  - Examine the effects of climate change on water availability and groundwater vulnerability due to sea level rise, and predicted changes in precipitation and evapotranspiration patterns and rates.
  - Establish a venue for a periodic exchange of ideas between resource managers, policy makers, and researchers.

WS-13 Develop agency capabilities to provide rapid deployment of resources in immediate response to intense precipitation and storm events through use of Next RAD technology.

WS-14 Cultivate partnerships with federal and state agencies and professional associations with expertise in integrated water resource planning (such as the U.S. Army Corps of Engineers Institute for Water Resources, the United States Geological Survey, and Water

Foundations) as sources of important research, reports, and information regarding climate change, and efforts being undertaken in other communities.

WS-15 Monitor changes in rainfall patterns, temperature means and extremes and sea level rise through coordination with NOAA and other key organizations/partners to better predict future wet-season and dry-season rainfall. Monitor emerging science in order to assess the adequacy of regional climate models. Choose an annual conference or other venue at which such trends can be reviewed at regular intervals.

WS-16 Manage water storage in the region's publicly-owned uplands and wetlands and in other land uses compatible with water storage, including wetland restoration, certain agricultural operations and certain renewable energy production facilities. This will further serve to protect high quality drinking water supply, increase aquifer recharge, and as a means for managing saltwater intrusion.

WS-17 Support complete implementation and funding for the Comprehensive Everglades Restoration Plan (CERP) and its updated versions as fundamental to Everglades restoration, to include increased freshwater flows to the Everglades system, thereby improving water quality, maximizing regional freshwater storage and aquifer recharge, and providing potential to abate saltwater intrusion, which will become increasingly important under variable climate conditions and in the face of sea level rise.

WS-18 Combine existing and develop new land acquisition priorities in a regional setting to protect high quality drinking water supply.



*Recommendation: Mitigate climate change on water supplies, water and wastewater infrastructure, and water management systems.*



## Natural Systems

Southeast Florida's natural communities exist within specific climate, water and salinity regimes; coral reefs and seagrasses grow in clear, shallow seawater with abundant sunlight and stable temperatures while mangroves thrive in the often brackish areas between the low and high tide lines. Freshwater-dependent hardwood hammocks and pine rockland forests support an abundance and diversity of rare plants and animals unrivaled in the United States. Similarly, Everglades tree islands depend upon wet and dry seasonal rainfall patterns that have existed for centuries. Climate change threatens many of the native plants and animals important to Southeast Florida's culture, economy and distinctive sense of place.

Changing weather patterns are not new to the native flora and fauna of Southeast Florida. Plants and animals are always living and competing on the edge of their limits. Wetland plants gain ground, moving up the slope in wet years and perhaps losing that same ground in dry years. But in many climate change scenarios, the speed and direction of such changes may be unprecedented. Climate change may exceed the capacity of native species to keep pace. By taking specific action now, we may be able to manage our native flora and fauna without losing species diversity and without introducing potentially harmful species.

Coral reefs are vital to local fisheries and the economy. Healthy oceans provide most of the oxygen in the air we breathe. Much research is already underway regarding the impact of climate change on the world's oceans. Locally, strategies are being developed to maintain our ocean in the face of climate change. In estuarine systems, mangroves and seagrasses are primary converters of sunlight energy to food energy. However, they are both limited



*Climate change threatens many of the native plants and animals ...*



*... important to Southeast Florida's culture, economy and distinctive sense of place.*

by water depth. As seas rise, they may not survive in their current locations. It will be incumbent on us to ensure that newly inundated areas are available for them to colonize. The fate of freshwater wetlands is currently harder to predict. Tide water may reach further inland and some freshwater sources may become more brackish. These 'lightly salty' estuaries can be biologically healthy habitats but we must ensure that other land uses, including drinking water supplies, are not threatened.

Most of the regions' freshwater wetlands and native uplands are supplied with rainwater. At this time, no one knows exactly what changes in rainfall patterns are in store for us. What we do know is that storage of freshwater is an important mitigation option whether rainfall is too much or too little – or both. Having freshwater storage options allows us to collect flood waters and hold them for later release during drought.

Given the opportunity, some species can adapt, migrate, or transition. Adaptation and migration or transition, necessary for sustaining natural plant and animal communities, will require careful and thoughtful planning. Land use planning and land acquisition programs will have to allow for such transitions. Hardened shorelines may be transformed to living shorelines. Open lands or vacant parcels may be suitable locations for habitat restoration.

The following strategies recommend ways in which all levels of government can share information necessary to plan for and implement the maintenance of natural areas, rare and endangered native species populations as well as the green industries necessary for our local economy.

***GOAL: Implement monitoring, management, and conservation programs designed to protect natural systems and improve their capacity for climate adaptation.***

NS-1 Develop a vital signs status and trends monitoring program for biological communities. Key parameters may include rate of sea level rise, saltwater intrusion boundary and monitoring wells, landscape-level vegetation patterns, percent coral cover and condition in offshore reef zones, water temperature and pH in areas, and occurrence and range of invasive exotic plants and animal species.

NS-2 Promote collaborative federal, state and local government conservation land acquisition programs. Explore fee simple and less-than-fee approaches which reflect regional acquisition priorities and result in conserving a diversity of natural areas including hot spots of biological diversity, protecting open space and buffer areas to create or maintain resilience and adaptive capacity of existing natural areas to transition inland/upslope.

NS-3 Support regional fire management coordination efforts emphasizing frequent, low intensity fire regimes in wetland and pine forest systems to maximize habitat quality, resilience to change and carbon neutrality while preventing hazardous fuel load buildup that leads to major carbon releases.



*Goal: Implement monitoring, management, and conservation programs designed to protect natural systems and improve their capacity for climate adaptation.*

NS-4 Quantify monetary values of hazard mitigation and adaptation provided by natural systems using Ecosystem Services Valuation or comparable model. Create a sustainable funding mechanism for their protection and management.

NS-5 Maintain or restore multiple areas of habitat and large-scale connectivity to facilitate native species population stability and habitat shifts resulting from climate change.

NS-6 Coordinate and implement regional invasive exotic species prevention and control efforts to minimize the diversity and abundance of habitat-homogenizing exotic plants and animals by emphasizing prevention of new invasions and early detection/rapid response to nascent invasions.

NS-7 Coordinate “living shorelines” objectives at regional scale to foster use of natural infrastructure (e.g. coral reefs, native vegetation and mangrove wetlands) instead of or in addition to grey infrastructure (e.g. bulkheads).

NS-8 Leverage existing work of the Florida Reef Resilience Program’s “Climate Change Action Plan for Florida’s Coral Reef System 2010-2015” for protection of marine habitat.

NS-9 Engage and cooperate with marine resource agencies to maintain coral reef (e.g., selective breeding) and mangrove ecotones as estuarine habitat and natural barriers to storm surge that also maintain coastal biodiversity.

NS-10 Advocate for federal and state funding for applied monitoring and climate related science:

- identify economic and physical linkages between marine systems (e.g. reefs and mangroves) and hazard risk/damage claim reduction
- monitor coastal and freshwater marsh vegetation tolerance to changing salinity, depth and other climate variables
- improve data on estuarine bathymetry and use appropriate models to help identify habitats at risk
- develop refined climate projections, hydrologic and ecological models to aid in planning

NS-11 Support regulatory requirements that provide for ecologically beneficial uses of clean, dredged materials.

NS-12 Develop long-term turtle-nesting beach preservation and management strategies to reduce nest vulnerability and mortality.

NS-13 Compile information on rare plant species in threatened natural communities and develop adaptation plans that include, at a minimum, seed bank repository collection and assisted propagation.

NS-14 Maintain/restore urban tree canopy.

*Sea level rise from climate change is threatening the Florida Everglades, the backbone of our natural resource system.*





## Agriculture

Agriculture is consistently one of the three economic drivers to Florida's economy. When the economic impact of tourism, development and agriculture are reviewed over many years, agriculture tends to be the stabilizing component of the economy.

Southeast Florida is unlike any other growing area in the nation due to a 12-month growing season and ample local market potential. More than 250 different and unique crops grow in Southeast

Florida. These crops supply the entire east coast of the United States with winter vegetables, contributing to the food security of the nation. Many tropical and ethnic crops are also grown and marketed to the diverse population of the region.

Farmers are actively adapting Best Management Practices that efficiently utilize nutrient application (right time, right place) and conserve water resources. They are also evaluating alternative methods to utilize and retain water when it's not harmful to current or projected growing practices.

The agriculture community is committed to sustainability, and the economic viability of regional agriculture will allow farmers to remain on the land to grow food, fuel and fiber for area residents as well as the nation. Consideration of agricultural impacts is vital to any regional action plan which should include action plans to address flooding, salt-water intrusion, exotic pests and disease introduction and crop changes due to climate change.



*Consideration of agricultural impacts is vital to any regional action plan.*

***GOAL: Ensure the continued viability of agriculture in Southeast Florida through policies which remove barriers to production, promote economic incentives, improve water reliability, and provide research on best management practices, thereby encouraging sustainable production in the face of a changing climate.***

AG-1 Promote policies which preserve the economic viability of agriculture as the industry adapts in the face of climate change.

AG-2 Develop and seek regional, state, and county-based funding for willing buyer/willing seller Agriculture Purchase of Development Rights Program to maintain agricultural land for its

ability to lessen climate change impacts and provide for national food security.

AG-3 Support academic research in the agriculture sector on best management practices for crops presently grown or new crops which may be grown as climate conditions change in Southeast Florida.

AG-4 Provide incentives to growers/land owners to manage agricultural lands to lessen impacts of climate change regionally and provide environmental benefits (which may include, but not be limited to: open space, water aquifer recharge and storage, carbon sequestration, wind farms, biofuels, and wildlife habitat).

AG-5 Ensure availability of water supply, at reasonable cost, to meet the diversity of needs across Southeast Florida to include agricultural irrigation needs and crop freeze protection.

AG-6 Identify and reduce obstacles for permitting agricultural practices (including growing and selling produce) in urban areas, in order to encourage urban farming and reduce greenhouse gas emissions related to the transport of farm produce.



*More than 250 crops grow in Southeast Florida, contributing to the food security of the nation.*

## Energy and Fuel

The vast majority of the energy consumed in the region is to fuel our vehicles and to generate electricity for our buildings. It is widely understood that the most accessible and cost-effective way to reduce energy consumption is through efficiency and conservation. The recommendations in this area address these important strategies and also take the next step by encouraging the use of alternative and renewable energy. They call for public-private partnerships and addressing barriers, including regulatory processes, which currently prevent the broad application of these technologies. Recommendations are comprehensive, ranging from setting regional goals, increasing renewable energy capacity to establishing a regional framework to deliver finance options. Recommendations also aim to reduce idling and prepare our region for the shift to plug-in electric vehicles.

***GOAL: Increase renewable energy capacity and reduce consumption of electricity and fuel.***



EF-1 Undertake regional efforts to advance energy efficiencies, energy conservation and the deployment of alternative and/or renewable energy technologies in existing and proposed developments through local ordinance, incentives, education, and energy efficiency financing strategies.

EF-2 Work toward the establishment of a regional framework to deliver Energy Efficiency and Renewable Energy finance options, in addition to other local government initiatives and partnerships, to achieve regional greenhouse gas emissions reductions, the use of alternative and renewable energy technologies, in furtherance of green sector economic development.

EF-3 Set a recurring five-year regional goal to increase renewable energy capacity and conservation – which includes the co-benefits of economic development and job creation – through revising building and zoning codes and architectural design guidelines to allow for, encourage, and integrate renewable energy sources into the power supply.

EF-4 Seek amendments to existing land development regulations and development standards and revise or eliminate provisions that act as a barrier to the installation and use of renewable energy systems pursuant to Section 163.04, F.S.

EF-5 Develop policies to facilitate and streamline the deployment of energy efficient and renewable energy such as the installation of LEDs and use of solar power for public infrastructure such as street lighting, parks, and parking facilities. Survey counties, cities and regional agencies with lighting infrastructure to determine the



*Recommendations aim to reduce idling and prepare our region for the shift to plug-in electric vehicles...*



*... and to advance energy efficiencies, energy conservation and the deployment of alternative and/or renewable energy technologies on a regional basis.*

level of deployment and to gather best practice policies and implementation steps to facilitate the application of efficient, environmentally sensitive (sea turtles), and responsive lighting practices in additional infrastructure.

- EF-6 Support or facilitate development and distribution of *local* sources of sustainable fuels and availability of fueling infrastructure. Adopt policies to facilitate the development of *locally sourced* sustainable alternative fuels, those achieving a reduction in lifecycle greenhouse gas emissions when compared to conventional fossil fuels (including, but not limited to, waste-based bio-diesel and methane gas from sources like landfills). Include these policies in regional plans and Local Comprehensive Plans. Identify incentives and modify local code to encourage the establishment of a local alternative energy industry.
- EF-7 Establish a working group of public and private stakeholders to develop a strategy to promote the use of Plug-in Electric Vehicles in the region.
- a. Establish locations where infrastructure and/or battery switching stations are needed. Solar charging and other renewable options should be designated a priority to maximize emission reduction benefits and to improve the community's emergency management preparedness in times of power outages.
  - b. Develop policies to provide incentives for the deployment of infrastructure to complement transit oriented corridors. Preferred and/or reduced parking fees should be a consideration for riders accessing transit facilities by electric or other alternative fuel vehicles. Transit facilities should develop plans to establish electric vehicle charging infrastructure.
  - c. Work with relevant stakeholders to streamline permitting processes associated with charging equipment to encourage the safe and expeditious installation on customer premises and elsewhere.
  - d. Coordinate monetary and non-monetary incentives available to the general public and organizations purchasing electric vehicles.
  - e. Support regional efforts to establish a framework for siting/locating public electric vehicle charging stations.
- EF-8 Develop a strategy to promote the development of truck parking with electrification facilities and the use of auxiliary power units to reduce extended idling by trucks.

- a. Survey state, local and regional transportation agencies for existing studies identifying trucking patterns and needs.
- b. Identify strategic locations for truck parking facilities and seek competitive funding opportunities as a region.

## Risk Reduction and Emergency Management

The recommendations presented in this section of the Southeast Florida Regional Climate Action Plan provide a foundation for establishing a more predictable physical environment in the face of climate change through regulations, adaptation strategies, and emergency operations, with the goal of reducing future economic losses and threats to public safety. Southeast Florida is no stranger to the devastating effects of hurricanes and other severe weather. Our experience has made us experts in planning, preparedness, response, mitigation, and recovery. Our emergency managers are trained in an all risk-based, all hazards approach. Disaster can strike anytime, anywhere. It takes many forms – a hurricane, a tornado, a flood, a fire or a hazardous spill, an act of nature or an act of terrorism. In fact, in the aftermath of September 11, homeland security preparedness was easily incorporated into Southeast Florida’s all hazards approach to emergency management. An emergency can build over days or weeks, or hit suddenly, without warning. Southeast Floridians are resilient and accustomed to this and can mitigate, prepare, respond, recover, and return to better than normal.

*Planning for more and possibly new weather-related threats needs to be incorporated into our emergency preparedness and hazard mitigation plans.*

Climate change differs, however, with impacts that may not be immediately evident as the changing conditions are slower and occur over longer time scales. With climate change there is no overnight return to “normal.” Sea level rise does not appear on the on 6 o’clock news weather map moving towards the coast of Florida. It is that difference that makes it more difficult for the general public to understand and to react to climate change. Yet, we are already experiencing more extreme weather conditions – from extreme rain to extreme droughts, from unseasonable heat waves to early cold fronts. Climate



is changing. Adapting and planning for more and possibly new weather-related threats need to be incorporated into preparedness procedures, and one step further is to include climate change in our emergency preparedness and hazard mitigation plans.

The collection of strategies and actions in this area is aimed at integrating climate change risk into all-hazards emergency management planning and response models. This approach provides support for the objectives of the Coastal Zone Management Act of 1972 which recognizes sea level rise as a threat to coastal communities and encourages strategies for improved protection of life and property, and builds upon requirements of Section 163.3178 and Chapter 252 F.S. relating to coastal and emergency management plans.

***GOAL: Provide a more resilient natural and built physical environment in light of climate change.***

- RR-1 Perform vulnerability analysis to identify and quantify the economic value of regional infrastructure at risk under various sea level rise scenarios and other climate change scenarios utilizing inundation mapping, modeling, and other appropriate tools. While the initial regional vulnerability assessment completed by the Compact Counties for use in this Regional Climate Action Plan has yielded important new insights on regional risk, additional and ongoing analysis is required to further refine our current understanding and to monitor changes in Southeast Florida's risk profile over time.
- RR-2 Evaluate and improve adaptation responses for communities at risk, to include:
- Development and implementation of methodologies for the assessment and evaluation of evacuation and relocation options
  - Development of model evacuation policies and procedures for communities at increased risk of flooding
  - Development of model relocation policies for affected communities.
- RR-3 Incorporate climate change adaptation into the relevant Local Mitigation Strategy (LMS) to reduce or eliminate long-term risk to human life and property from disasters. Within the LMS, update local risk assessments to include climate change in the hazard analysis and vulnerability assessment section. Develop strategies for hazard mitigation and post-disaster redevelopment planning.

RR-4 Identify transportation infrastructure at risk from climate change in the region, and determine whether, when, where, and to whom projected impacts from climate change might be significant. Employ inundation mapping, modeling and other appropriate tools to assess the vulnerability of transportation infrastructure to the projected impacts of climate change under various sea level rise and other climate change scenarios. At a minimum, assess the vulnerability of the following transportation infrastructure:

- local transportation networks of the Compact Counties
- the Regional Transportation Network designated by the Southeast Florida Transportation Council composed of interconnected, strategic corridors (roadway, rail line, waterway), hubs (airports, seaports, intermodal terminals, freight terminals, passenger rail and intercity bus terminals) and connectors critical to the mobility of people and freight and the region's economic competitiveness and quality of life (map included in Appendix D); and evacuation routes adopted under the Statewide Regional Evacuation Corridor Program.



*Recommendation: Communicate the risks related to climate change.*

RR-5 Enforce Coastal Construction Control Line and build upon goals, objectives and policies related to Coastal High Hazard Area designations in Comprehensive Plans.

RR-6 Adopt consistent plans at all levels of regional government that adequately address and integrate mitigation, sea level rise and climate change adaptation. The following plans must all be consistent: disaster recovery and redevelopment plans, comprehensive plans, long-range transportation plans, comprehensive emergency management plans, capital improvement plans, economic development plans, Local Mitigation Strategy, Climate Change Action Plan, and Future Land Use Plan.

RR-7 Continue to implement and enforce strong building codes that require new construction and substantial improvements to existing structures to mitigate against the impacts of flooding, severe winds, and sea level rise, and which are consistent with Climate Change Adaptation policy.

## Outreach and Public Policy

Outreach and Public Policy recommendations are combined in recognition of the fact that the best planning efforts in the world will not be implemented or reach their full potential without the support of the public, often through local government public outreach programs, and without the leadership of local, state and federal policy makers and private sector decision makers who are committed to a sustainable planet.

### Public Outreach

Today's world is marked by instant communication, immediate information and multitasking behaviors. News and information related to climate change is difficult to communicate in a sound bite. It's relatively easy to communicate the threat of an imminent storm, tornado or other natural disaster, but much more difficult to mobilize the public to hazards that unfold over years and decades. The state of the current economy also makes a long-term discussion on climate change more difficult when many Americans are thinking about short-term housing, employment and other immediate needs. And, of course, the science of climate change is still contested by some.

The strategies and actions in this area aim to educate stakeholders in all sectors and at all levels – from the general public and voters to elected officials, professionals and other decision makers. These are initiatives to inform and create a common understanding of the benefits of energy independence, energy use reduction, water conservation, smart growth, and natural area protection that will create demand for a healthy, sustainable and resilient region.

***GOAL: Communicate the risks related to climate change and the value of adapting policies and practices to achieve resilience throughout the region.***

- PO-1 Provide outreach to residents, stakeholders and elected officials on the importance of addressing climate change adaptation and preparedness and develop a program to educate specific interest groups about the Compact, Regional Climate Action Plan, and the benefits of Adaptation Action Area. Consider utilizing the Academy concept to educate elected leaders, academic interests and other decision makers.
- PO-2 Collaborate among counties, municipalities and appropriate agencies to develop and carry out outreach/educational programs to increase public awareness about hazards



exacerbated by climate change, mitigation efforts, and adaptation strategies to minimize damage and risk associated with climate change.

*Successful implementation of the Regional Action Plan strategies requires continued collaboration.*

- PO-3 Provide education and improve communications on energy conservation and available technologies with a focus on both short-term and life-cycle economic benefits, and incentives available within the region.
- PO-4 Modify existing and encourage new public outreach, education and messaging programs associated with natural areas including upland, wetland, marine, coastal and nearshore environments and the Everglades to include climate change mitigation and adaptation messaging and volunteer opportunities to create awareness about the impacts of climate change on the environment.
- PO-5 Initiate a regional public education campaign to educate residents, business owners, and policy makers on the merits of preserving open land as an “insurance policy” for adaptation to sea level rise in Southeast Florida.
- PO-6 Develop early warning systems and social media applications to both inform residents and visitors of extreme high-tide events and to raise overall awareness on sea level rise and climate change issues. Also consider roadway signage for tidal flooding zones.

- PO-7 Leverage resources for campaign and promotional advertisements by coordinating public transportation messaging in the region to attract non-transit-dependent (choice) riders. Messages should focus on making riding transit “cool.”



- PO-8 Deploy social media applications, to facilitate use of transit including access to real-time information such as arrival times.
- PO-9 Develop strategies to promote fuel efficient driving habits, including anti-idling practices, and to raise awareness of rules and safety practices for sharing the road

with bicyclists and pedestrians. Conduct best practice research on existing campaigns and look for opportunities to integrate tools into existing high school, county and municipal driver education courses, traffic school curriculum, truck driver training, and fleet associations. Also include messaging on the benefits of purchasing fuel efficient vehicles.

PO-10 Coordinate outreach efforts with states, regions and counties that are subject to the impacts of climate change with special emphasis on coastal entities experiencing sea level rise and coastal flooding to create a national Climate Adaptation Coalition for the purpose of impacting public policy and influencing appropriations requests.

PO-11 Create a working group to expand marketing efforts such as Redland Raised to promote local organic and sustainable agriculture and economy by connecting farmers with local users such as restaurants, grocers, and farmers markets and encourage the establishment of farm-to-school initiatives and community supported agriculture programs.

## Public Policy

Public policy development and advocacy are core components of the Compact and commitments that the Compact partners have fulfilled. Recent amendments to Florida law that provide for Adaptation Action Area designation for areas vulnerable to the impacts of climate change, and the subsequent request by members of Congress to amend federal law to mirror this action are just a few examples of the Compact's success to influence policies. The Regional Climate Action Plan provides the next step to gain support for ordinances, regulations and state and federal policies on behalf of the region. The Public Policy goal complements numerous other recommendations noted in the Sustainable Communities and Transportation Planning sections of this Plan.



*On June 24, 2010, partners in the Southeast Florida Climate Compact convened a regional press event to respond to the Deepwater Horizon Oil Spill in an urgent call for comprehensive federal energy policy and a demand for a permanent ban on oil drilling and exploration in Florida's territorial waters and along Florida's outer continental shelf.*

Additionally, the continuation of regional efforts to influence public policy is key to ensure that state and national policies considered during these uncertain times do not impede regional efforts already underway. Compact successes to date can easily be undermined without vigilance in monitoring policy developments on all levels of government.

***GOAL: Guide and influence local, regional, state and federal climate change related policies and programs through collaboration and joint advocacy.***

- PP-1 Compact Partners will continue the support for the core Compact policies and the role of joint advocacy as provided for in Sections 1 – 4 of the Compact calling for changes to federal law that better recognize the unique vulnerabilities of Southeast Florida to climate change and for providing appropriations based on vulnerabilities, with special attention to funding infrastructure projects to adapt to sea level rise.
- PP-2 Compact partners will continue to develop state and federal legislative programs on a yearly basis that will serve as guidance for advocacy in Tallahassee and Washington, D.C. Regional programs will be considered for inclusion into Compact partners' legislative packages and joint advocacy in Tallahassee and Washington, D.C., is encouraged when appropriate.
- PP-3 Continue to seek the support of other municipal and county jurisdictions including the Leagues of Cities, Florida Association of Counties (FAC), etc. within Florida and the National Association of Counties (NACo) and other entities that influence national policy for the purpose of building coalitions, sharing resources, and influencing state and national policy on mutual climate related issues through joint advocacy.
- PP-4 Counties, municipalities, regional agencies and other appropriate government and private sector partners should integrate consideration of climate change impacts and adaptation strategies into existing and future systemwide planning, operations, policies, and programs. The guiding principles developed by the Interagency Task Force on Climate Change Adaptation<sup>6</sup> for federal agencies should be incorporated by entities when designing and implementing adaptation strategies:

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<sup>6</sup>( <http://www.fedcenter.gov/programs/climate/guidingprinciples/> )

- Prioritize the most vulnerable
- Use best-available science
- Build strong partnerships
- Apply risk-management methods and tools
- Apply ecosystem-based approaches
- Maximize mutual benefits
- Continuously evaluate performance

*We will continue to seek the support of entities that influence national policy for the purpose of building coalitions, ...*

- PP-5 Advocate for new authorization of the federal surface transportation programs with increased priority for funding public transit and non-motorized travel and integrated regional and local planning as means to reduce the greenhouse gas emissions from the transportation sector. Such a federal program should explicitly incorporate climate change and shift priorities toward programs that encourage reinvestment in existing infrastructure and communities (“fix-it-first” programs), support public transportation and transit-oriented development, and address congestion management through means other than new road building.
- PP-6 Support federal actions to reform transportation models and enhance the National Environmental Policy Act (NEPA) processes to integrate climate change analysis. The essential purpose of NEPA is to ensure that environmental factors are weighted equally when compared to other factors in the decision making process. NEPA processes are central to highway and transit project investment analysis.
- PP-7 Advocate for stronger Corporate Average Fuel Economy (CAFE) Standards and other initiatives to promote clean fuel alternatives and encourage more stringent vehicle emission standards in recognition of the value of these initiatives to mitigate the impacts of climate change by reducing greenhouse gas emissions.
- PP-8 Support and advocate for continued implementation and funding on the state and federal levels for the Comprehensive Everglades Restoration Plan (CERP) in recognition of the important role of CERP in climate adaptation planning and local water resource management related to regional water storage and aquifer recharge, important under variable climate conditions and sea level rise.
- PP-9 Advocate to interests in Tallahassee for the preservation of the authority and resource capacity of the Water Management Districts in support of their continued

participation in integrated water resource planning, particularly in Southeast Florida where climate change and sea level rise pose additional challenges to the complex issues of alternative water supply development, Everglades restoration, salt water abatement, and drainage and flood control operations.

*... sharing resources, and influencing state and national policy on mutual climate related issues through joint advocacy.*

- PP-10 Encourage federal support for research and investigations of potential energy efficiencies in pumping and water treatment processes necessary for meeting energy reduction goals concurrent with a growing reliance on pumps and advanced treatment technologies for drainage and flood control, water production and wastewater operations.
- PP-11 Urge Congress to provide recognition of an “Adaptation Action Area” designation in federal law for the purpose of prioritizing funding for infrastructure needs and adaptation planning, with special attention to modifications in law that enhance funding opportunities through USACE and EPA appropriations processes, as requested by members of Congress.
- PP-12 Urge Congress to pass legislation that would create a permanent funding source to finance infrastructure projects to adapt to the impacts of climate change with emphasis on investments in areas such as water management, water supply, transportation and other projects that serve to reduce risks to urban infrastructure from extreme weather events and rising sea levels.
- PP-13 Urge Congress to pass legislation that removes federal barriers posed by the Federal Housing Finance Agency to Property Assessed Clean Energy (PACE) residential initiatives that are intended to assist property owners to finance energy efficiency and renewable energy improvements.





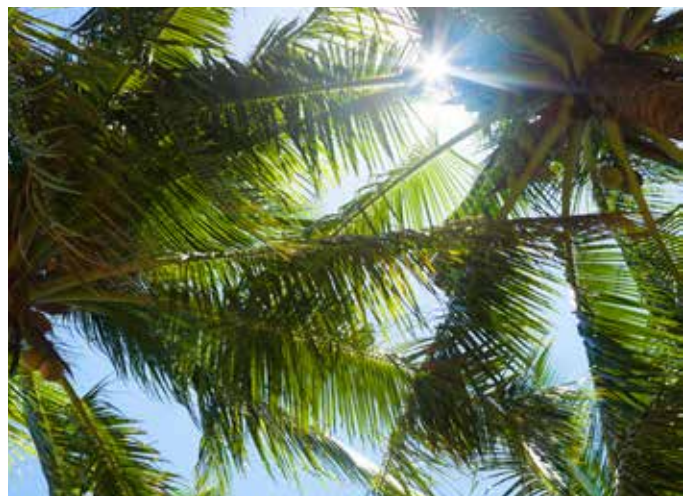
## VII. Conclusions

This Regional Climate Action Plan provides the initial framework for an ongoing regional commitment to building resilience and sustainability as cornerstones of Southeast Florida's regional economic, social and ecological system. The five-year scope of this document is indicative of the fact that this is the beginning rather than the end of the Regional Compact process. The Compact Counties recognize that a given document is less important than the ongoing collaborative process of assessing progress over time, developing new policies and collaborations among the public, private and nonprofit sectors to adjust accordingly and incorporating new knowledge provided by ongoing scientific endeavors. While much can be learned about sustainability and resilience from past experience, new technologies, changes in the regional economy and changes in the historical climatic conditions within Southeast Florida require active learning over the decades to come. The Southeast Florida Regional Climate Change Compact has developed the institutional capacity to enable the collaborative learning required to meet these challenges over time.

### The Significance of the Southeast Florida Regional Climate Change Compact

While providing direct benefits to the region, the Compact has provided a national model for state and federal agency engagement with local government around the specific issues of place. As the Compact is led by local government and further, as the Compact represents a significant aggregation of effort by four counties containing over 100 municipalities, it has become a highly efficient mechanism for state and federal agency engagement in the local process. Since its adoption in early 2010, the Compact has received extensive technical support from NOAA, the United States Geological Survey, the U.S. Army Corps of Engineers, EPA Region IV as well as the Florida Department of Transportation, the Florida Department of Economic Opportunity and the South Florida Water Management District.

The regional scale of the Compact has enabled participants to develop resilience strategies that effectively integrate human and natural systems. The Regional Climate Action Plan has effectively connected resilience efforts within the urban core of Southeast Florida with broader ecosystem scale efforts including





comprehensive Everglades restoration, protection of the Southeast Florida coral reef tract, and regionally important threatened and endangered species and habitats. The ecosystem services provided to the human settlements of the region are evident in the nature of projected vulnerabilities such as salt water intrusion into local drinking water supplies and the increased exposure to storm surge impacts associated with the loss of natural barriers. And the strategies developed to enhance environmental and habitat quality fully recognize the benefits these strategies will have for the ongoing livability of the region.

*The Compact has provided a national model for state and federal agency engagement with local government.*

The Compact has enjoyed stable, bipartisan political support since its initiation in 2009 despite the swings in the political salience of global climate change observed over this time in state and federal political dynamics. This stability has remained despite the departure of early champions of the Regional Compact from County Commission seats and a change of administration within one of the four Compact Counties. The scope and extent of regional engagement made possible by the Regional Compact has served to foster on-going bipartisan support as the Compact continues to enjoy strong political leadership from each of the Compact Counties.

As an ongoing collaboration, the Compact provides a formal framework for policy development, implementation and evaluation that is so critical to enable learning over time. Implementation of this Regional Climate Action Plan will require the active participation of many actors, not least of which are the many municipalities within the four county region who have primacy in many cases for the decisions that will determine the shape of Southeast Florida in the years to come. The Regional Compact process has benefited greatly from the active participation of municipal representatives who have contributed much perspective and many insights thus far. As implementation progresses, this ongoing collaboration will be all the more critical for success.

## Next Steps

The release of this Regional Climate Action Plan is the first of several subsequent steps to follow in the Regional Compact process. The following provides an overview of these subsequent next steps:

- Upon completion of the final Regional Climate Action Plan, the Compact Staff Steering Committee will transmit the final plan to the four Boards of County Commissioners for the acceptance and/or approval of the final recommendations.
- The Compact Counties will continue development of a set of progress indicators for use in monitoring and evaluating the impact of implemented recommendations in building resilience and sustainability in Southeast Florida.
- The Compact Counties will continue to collaborate with the Southeast Florida Regional Sustainable Communities Initiative funded by the U.S. Department of Housing and Urban Development in addressing a wide range of sustainability and livability considerations for Southeast Florida. The Compact Counties will continue to collaborate with the Southeast Florida Regional Partnership in addressing a wide range of sustainability and livability considerations for the region, including through development and implementation of the Seven50 Regional Vision and Blueprint for Economic Prosperity.
- Annually, the Compact Policy Coordination Team will continue the Compact energy and climate policy coordination process for state and federal legislation and will continue to monitor legislative developments in both levels of government.
- In early 2013, the Sea Level Rise Projection Technical Advisory Committee will reconvene following the December 31, 2012 publication deadline for peer-reviewed scientific literature to be used in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change due in 2014. Members of the technical advisory committee have advised that they anticipate many new publications in 2012 that will have significant bearing on mid- to longer-terms rates of sea level rise as an issue of concern for Southeast Florida. At that time, the technical committee will provide regionally consistent sea level rise projections for use in the Compact process through 2100 while adjusting guidance provided for 2030 and 2060 as warranted by the science.

*There are more than 100 local governments in the region, each at varying stages of climate mitigation and adaptation planning and implementation.*

This first Regional Climate Action Plan recommends several first steps toward reducing emissions and building resilience to climatic impacts across Southeast Florida, but it isn't the final outcome of the Compact. Compact participants have the opportunity to learn from early implementation: what works and what doesn't, what are the implications of new science, and what are the



*Our individual and collective steps will result in a more resilient region.*

implications of changes in state and federal policy. Over the next few months, the Compact Counties will continue working with the Coastal Services Center at NOAA to develop a set of performance indicators for use in monitoring and evaluating progress made in implementing this first Regional Climate Action Plan. By implementing an ongoing set of performance metrics for this Regional Plan and by remaining engaged with leading practitioners of science and public policy, the Compact will be well positioned to capitalize on success, learn from challenges, and produce subsequent future iterations of this Regional Climate Action Plan as a means to securing a more prosperous Southeast Florida.

Join us on this journey and visit our website for more information, source documents and to view the Implementation Guide: [southeastfloridaclimatecompact.org](http://southeastfloridaclimatecompact.org).

## VIII. Appendices

### Appendix A - Southeast Florida Regional Climate Change Compact



### Southeast Florida Regional Climate Change Compact

**WHEREAS**, there is consensus among the world's leading scientists that global climate change is among the most significant problems facing the world today; and

**WHEREAS**, Florida is considered one of the most vulnerable areas in the country to the consequences of climate change with Southeast Florida on the front line to experience the impacts of climate change, especially sea level rise; and

**WHEREAS**, Broward, Miami-Dade, Palm Beach and Monroe Counties, herein the four counties that constitute the Southeast Florida Region, share in common a strong quality of life rooted in the region's rich cultural heritage, vigorous economy, and environmental resources of global significance; and

**WHEREAS**, the aforementioned four counties of Southeast Florida, which represent approximately 30% of the population of the State of Florida, are physically linked one to the other by the Atlantic Ocean coastline and share some of the world's most renowned natural resources such as the Everglades, our unique coral reefs, beautiful beaches, and fragile Keys ecosystem; and

**WHEREAS**, the four counties of Southeast Florida and their respective populations, totaling more than five million residents, are expected to share in disproportionately high risks associated with climate change due to low land elevations, rising sea level projections, and anticipated increases in tropical storm events; and

**WHEREAS**, rising sea levels could limit the effectiveness of critical drainage infrastructure, endanger beaches, and coastal natural resources and increase incidents of saltwater intrusion on the Biscayne Aquifer – putting at risk the drinking water supply for the entire population of Southeast Florida; and

**WHEREAS**, local governments, and the region as a whole, must give significant consideration to adaptation strategies designed to protect public infrastructure, property, water resources, natural areas and native species, and basic quality of life; and

**WHEREAS,** the aforementioned four counties of Southeast Florida account for a combined Gross Domestic Product of more than \$2.5 billion annually and more than 37% of statewide economic output; and

**WHEREAS,** while the four counties of Southeast Florida have independently taken steps to address global climate change, all parties recognize that coordinated and collective action on this, the defining issue for Southeast Florida in the 21<sup>st</sup> Century, will best serve the citizens of the region;

**NOW THEREFORE, BE IT RESOLVED BY THE BOARDS OF COUNTY COMMISSIONERS OF THE FOUR COUNTIES OF SOUTHEAST FLORIDA:**

**SECTION 1:** That each county shall work in close collaboration with the aforementioned counties of Southeast Florida party to this compact to develop a joint policy position urging the United States Congress to pass legislation that recognizes the unique vulnerabilities of Southeast Florida to the impacts of climate change and to further a joint policy position that includes specific recommendations regarding the allocation of federal climate change funding based on vulnerability to climate change impacts. Such recommendations might include designation of areas of Southeast Florida as uniquely vulnerable and of federal interest for the purpose of securing enhanced levels of federal participation in regional adaptation projects.

**SECTION 2:** That each county shall work in close collaboration with the other counties party to this compact to develop additional legislative policy statements relating to global climate change and future legislation to be considered by the Congress of the United States for transmittal to the Congressional Delegation representing, in part or in whole, districts within the area covered by this compact.

**SECTION 3:** That each county shall work in close collaboration with other counties party to this compact in developing joint position statements on proposed State legislation and energy/climate policies including but not limited to issues such as the region's energy and climate security and a renewable energy portfolio standard that defines renewable energy sources as wind, solar, geothermal, biomass, landfill gas, qualified hydropower, and marine and hydrokinetic energy, and also including nuclear energy, and to collaborate on other emerging energy/climate issues that may be considered by the 2010 Florida Legislature for transmittal to the Legislative Delegation representing, in part or in whole, districts within the area covered by this compact.

**SECTION 4:** That each county shall work with other counties party to this compact in developing joint position statements for future State legislation that may be considered by the Florida Legislature for transmittal to the Legislative Delegation representing, in part or in whole, districts within the area covered by this compact.

**SECTION 5:** That each county shall commit appropriate staff resources and expertise, within budget constraints, to participate in a Regional Climate Team with other counties party to this compact toward the development of a Southeast Florida Regional Climate Change Action Plan.

**SECTION 6:** That each county shall work with other counties party to this compact in developing a Southeast Florida Regional Climate Change Action Plan, understanding that no county will work at cross-purposes with the other counties. The Action Plan could, at a minimum, include the following components:

- (a) A baseline of greenhouse gas emissions for Southeast Florida;
- (b) Strategies for coordinated emission reductions throughout the built environment to include the use of energy efficiency, energy conservation, and the use of demand-side renewable energy resources;
- (c) Strategies for coordinated emission reductions from the transportation sector to include increased reliance on public transit, emerging vehicle technologies, and advanced biofuels;
- (d) Strategies for coordinated emission reductions resulting from changes in local and regional land use;
- (e) Strategies for the coordinated regional preparation for and adaptation to a rapidly changing global environment based upon regional mapping of projected sea-level rise and any resulting amplification of localized impacts of tropical cyclone events. Such strategies shall incorporate climate preparation concerns for the regional economy, regional infrastructure and the built environment, social and cultural needs, and natural systems within the four counties party to this compact.

**SECTION 7:** That each county shall commit to participating with other counties party to this compact in hosting the Second Southeast Florida Regional Climate Change Summit in October, 2010.



Adopted December 8, 2009



Adopted December 1, 2009



Adopted January 20, 2010<sup>1</sup>\*



Adopted December 15, 2009

\*City of Key West: Resolution of support for the Compact – December 15, 2009

<sup>1</sup> Second adoption date following minor changes made by partnering Counties



## Appendix B - Work Group Recommendations

*The recommendations put forth in the Regional Climate Action Plan were developed through a collaborative process involving nearly 100 subject matter experts from a host of professions representing the public and private sectors, area universities, and not-for-profit organizations. These stakeholders brought to the table the knowledge of their “craft” as well as information on successful initiatives already underway locally or in other communities.*

*Many of the recommendations build upon best practices sprinkled throughout our region, such as regional collaboration on transportation planning and land use criteria that foster walkable and healthy communities. Others delve into “new” frontiers in calling for the integration of climate change into planning and decision-making processes in ways that no local government has yet implemented.*

*Below are the full set of recommendations, organized as focal areas and strategies, offered by each of the three working groups: Built Environment Working Group, Land and Natural Systems Working Group, and the Transportation Working Group, as they were submitted.*

### Built Environment Work Group

#### Focal Areas and Strategies

Final Draft August 15, 2011

#### Focal Area 1

#### **Create Land Development Strategies for Climate Resilience, Sustainable Growth, Risk Reduction, and Emergency Preparedness**

There is a demonstrated synergy between sustainable development practices and efforts to improve community resilience to climate change impacts. By promoting a “no regrets” approach, it is possible to affect positive outcomes that further regional climate change mitigation and adaptation goals while improving community livability, economic opportunities and resource sustainability. These adaptation strategies address: building design, elevation and hardening; transportation networks; other critical public infrastructure (potable water, wastewater, stormwater and energy/power); and green infrastructure.

#### Strategies

1) Regional Planning: Incorporate “Adaptation Action Area” designation, and other applicable provisions, into local Comprehensive Plans and regional planning documents to identify those areas deemed most vulnerable to sea level rise and other climate change impacts including extreme high tides, heavy local rain events, storm surge, or inadequate drainage systems.

Action 1: Perform vulnerability analysis to identify and quantify the economic value of regions and infrastructure at risk under various sea level and other climate change scenarios utilizing inundation mapping, modeling, and other appropriate tools.

Action 2: Identify and designate “Adaptation Action Areas” (AAA) based on the results of vulnerability analyses. Inside AAA, local governments should identify “Adaptation Areas,” “Restoration Areas,” and “Growth Areas.”

Adaptation Areas – designate areas within the AAA that include developed vulnerable land targeted for infrastructure improvements or modified land use and/or development practices in order to reduce risks and improve hazard mitigation. In these areas, the high cost of retrofitting, building and maintaining infrastructure is outweighed by the return in investment.

Restoration Areas - designate areas within the AAA that include vulnerable lands that may or may not be already developed and could include Coastal High Hazard area and high storm surge areas. Local governments should place priority on the acquisition of land in these areas for restoration, agriculture, or recreational open space.

Growth Areas – to consist of areas outside of the AAA where growth is encouraged due to higher topographic elevations and the presence of existing transportation infrastructure. These designated areas should be developed with Urban Design guidelines that address character of urban place and provide a high quality pedestrian experience through landscaping, and the creation of public space.

Action 3: Provide public outreach and education to better inform the community about the need for climate change planning, the provision in state law that provides for the designation of “Adaptation Action Areas,” and the purpose and implications of such a designation.

2) Local Planning and Zoning: Develop policies, strategies, and standards that will serve to reduce future risk and economic losses associated with sea level rise and flooding in these designated areas through infrastructure improvements and by directing future development and redevelopment to areas outside AAA. This will also foster sustainable growth patterns, multi-modal transportation options, transit, mixed use development, and the use of sustainable building techniques.

3) Building Code: Revise building codes and require increased resiliency of buildings and infrastructure for new and redevelopment, particularly for those areas within Adaptation Action Areas.

4) Emergency Preparedness: Evaluate adaptation responses for communities at risk and enhance preparedness measures to address climate-related risks and hazards.

Action 1: Improve adaptation responses for communities at risk with the development and implementation of:

- Methodologies for the assessment and evaluation of evacuation and relocation options
- Model evacuation policies and procedures for communities at increased risk of flooding
- Model relocation policies for affected communities

Action 2: Incorporate climate change adaptation in the relevant Local Mitigation Strategy (LMS) to reduce or eliminate long-term risk to human life and property from disasters. Within the LMS, update local risk assessments to include climate change in the hazard analysis and vulnerability assessment section.

5) Education: Develop outreach programs to increase public awareness about hazards exacerbated by climate change and mitigation and adaptation strategies by the local government to minimize damage and risk.

## Focal Area 2

### Ensure the Long-term Adequacy of Surface Water Management Systems, Water Supplies and Wastewater Infrastructure

Climate change presents an array of challenges to future water supply planning and water management efforts. The combined influences of altered precipitation patterns, increased groundwater elevations, and sea level rises present complex hurdles to regional and local efforts in providing critical drainage and flood control; high quality, sustainable, and abundant water supplies; and effective management of stormwater and wastewater. By assuming an integrated approach to water resource management and climate adaptation planning, the influence of a changing climate on the quality and quantity of water resources and related infrastructure can be effectively addressed. Interrelationships between stormwater management, water supply, wastewater disposal and water reuse must be reviewed and actions implemented to ensure the beneficial supply and use of all available water resources in a manner that benefits the public, protects resources, accounts for future conditions, and provides for necessary levels-of- service.

#### Strategies

1) Risk Assessments: Inventory existing potable water, wastewater, and stormwater treatment, delivery and collection systems; assess the status of each component; determine the potential impact from climate change; and develop different climate change scenarios and adaptation strategies for high-risk utilities and/or infrastructure which may require replacement, reinforcement, or relocation to ensure the long term viability of the system.

Action 1: Identify and/or develop baseline hydrologic conditions to provide a measure for comparison in assessing the potential impacts of climate change on regional and local water resources and infrastructure, including the short-term the development of a saltwater intrusion baseline.

Action 2: Utilize inundation mapping, variable density models, and water management models to identify areas and infrastructure at risk.

Action 3: Identify and quantify vulnerable wellfields, water supply infrastructure, wastewater collection and/or treatment infrastructure, and drainage facilities, and devise strategies to protect or relocate, as needed.

2) Reuse and Aquifer Recharge: Identify opportunities to advance beneficial use of stormwater and reclaimed water to reduce potable water demands and provide aquifer recharge and implement as appropriate, as an alternative to disposal.

Action 1: Evaluate the impacts of rising sea and groundwater levels on soil storage, infiltration rates and inflow to stormwater and wastewater collection and conveyance systems; consider longer-term influences on water quality; and develop strategies for implementing reclaimed water and stormwater reuse projects that account for current and future conditions.

Action 2: Identify potential sites for use in providing stormwater storage and mechanisms to increase aquifer recharge as a means for managing saltwater intrusion and enhancing water supplies.

Action 3: Consider regional projects and opportunities to gain efficiencies through collaborative approaches and projects.

3) Integrated Water Resource Planning: Develop Integrated Water Management Plans that present a joint assessment and planning strategy involving local water utilities, wastewater service providers, water managers, and partners to the Southeast Florida Regional Climate Change Compact, for coordinated consideration of stormwater use and disposal, traditional and alternative water supplies, wastewater disposal and reuse, and water conservation measures for use by local leadership to guide planning decisions as well as amendments to applicable codes and regulations.

4) Drainage and Flood Control: Identify and pursue adaptation strategies to improve drainage and flood control in areas designated as “Adaptation Action Areas” and where changing hydrologic conditions are anticipated to impact surface water management.

Action 1: Coordinate with the South Florida Water Management District, Drainage/Water Control Districts, and public works officials to identify flood control and stormwater management infrastructure already operating below the design capacity.

Action 2: Develop and apply appropriate hydrologic and hydraulic models to further evaluate the efficacy of existing water management systems and flood control/drainage infrastructure under variable climate conditions.

Action 3: Develop and test adaptation improvements needed to maintain existing levels of service and conduct a cost-benefit analysis to prioritize potential improvements, trade-off decisions, and any proposed land acquisitions.

Action 4: Incorporate and prioritize preferred improvement projects in capital improvement plans and pursue funding.

5) Everglades Restoration: Support and advocate for complete implementation and funding for the Comprehensive Everglades Restoration Plan as fundamental to Everglades restoration, but also the viability of local water resource management efforts given the overall contributions of the Everglades to regional water storage and aquifer recharge, which will become increasingly important under variable climate conditions and in the face of sea level rise.

### **Focal Area 3**

#### **Reduce Greenhouse Gas Emissions through Improved Regional Strategies for Energy Efficiency, Conservation & Renewable Energy**

Climate change mitigation can be addressed through plans, incentives, and regulations which promote the efficient use of energy in buildings, transportation and industry; through the use of less carbon-intensive energy sources; and through the production and use of renewable energy. Regulatory barriers to alternative energy generation must be removed in order to allow these sources of energy to be tapped. Federal and state policies that promote alternative energy use, such as renewable energy portfolio standards for utilities and tax credits for home owners installing small-scale renewable systems must be developed.

#### **Strategies**

1) Regional Coordination: Undertake regional efforts to advance energy-efficiencies, energy conservation and the deployment of renewable and alternative energy technologies in existing and proposed developments through local ordinance, incentives, education, and energy efficiency financing.

2) Green Building Code: Incorporate sustainable building and neighborhood ratings or national model green building codes, including but not limited to those defined in Section 255.253(7), F.S., into municipal codes region-wide.

3) Local Codes: Develop and implement amendments to local and state building codes, land use regulations and laws to facilitate and encourage the installation of renewable energy systems. Examine existing zoning codes and development standards and revise and update provisions that act as a barrier to the installation and use of renewable energy systems.

4) Finance: Work collaboratively toward the establishment of regional framework to deliver Energy Efficiency and Renewable Energy finance options, in addition to other local government initiatives and partnerships, to advance regional greenhouse gas emissions goals, the use of alternative and renewable energy technologies, and in furtherance of green sector economic development.

5) Goals: Set recurring 5-year regional goals to increase renewable energy capacity – which include the co-benefits of economic development and job creation -- through revision of building and zoning codes and architectural design guidelines to allow for, and encourage, integration of renewable energy sources and technologies.

6) Measures: Build upon established methodologies and mechanisms for Greenhouse Gas measurement, verification and validation to create quantifiable recordkeeping and reporting which conforms with accepted global standards.

7) Education: Provide education and improve communications on energy efficiency and available technologies with a focus on both short-term and life-cycle economic and energy gains, incentives available within the region (federal, state, local and commercial).

## Land and Natural Systems Working Group

### Priority Recommendations

#### Monitor Climate Change

- a. Establish coordination with NOAA regarding trends in rainfall patterns. Choose an annual conference or other venue at which such trends can be reviewed at regular intervals.
- b. Monitor changes in rainfall patterns to better predict future wet-season and dry- season rainfall as well as the salt content in the wells of agricultural lands.
- c. Develop a vital signs status and trends monitoring program for biological communities. Key parameters may include rate of sea-level rise; saltwater intrusion boundary and monitoring wells; landscape-level vegetation patterns; percent cover in offshore reef zones; water temperature and pH in areas; and occurrence and range of invasive exotic plants and animal species. Ensure Department of Health beach water quality monitoring continues and expand methods of notifying the public and tourism industry when exceedances are detected.

#### Water Storage

It is probable that climate change will also bring about changes in rainfall patterns, either by quantity, intensity in any given rain event or seasonality and perhaps all of these. Although the extent of such changes cannot be known, it is known that fresh water storage can ameliorate such changes.

- a. Identify lands to be used for water storage to ameliorate changes in rainfall patterns. Storage areas and methods should be planned and located to accommodate drinking water supply, agricultural consumption, accepting flood waters and to maintain hydroperiods on natural lands.
- b. Identify and promote other land uses compatible with water storage including wetland restoration, certain agricultural operations and certain renewable energy production facilities. Develop joint acquisition and management strategies with these other entities.
- c. Manage water storage in the region's publicly-owned uplands and wetlands.
- d. Encourage continued funding for the Comprehensive Everglades Restoration Plan (CERP).
- e. Support CERP Everglades Agricultural Area (EAA) flow-way plans that increase freshwater flows to the Everglades, maximize freshwater storage and provide opportunities to improve water quality by establishing marsh communities.

### **Resource Acquisition**

Acquisition efforts should emphasize preserving existing species diversity as well as considering changing rainfall patterns and elevated saline waters, increasing the region's resiliency against the impacts of natural hazards.

- a. Develop acquisition priorities in a regional setting to:
  1. Ensure preservation of many habitat types and that those types will be represented in a changing climate.
  2. Protect high quality drinking water supply
  3. Identify hot spots of biological diversity and ensure those locations are either protected or are identified for future land acquisition.
  4. Identify and protect higher level lands to which mangrove and salt-marsh species might 'retreat'.
- b. Assess acquisition priorities in light of changing rainfall patterns, i.e., if rainfall is more, is the parcel still valuable for identified vulnerable species, if rainfall is less, is the parcel still valuable to other vulnerable species. Consider linkages and migration opportunities for vulnerable species.
- c. Incorporate "Adaptation Action Area" designation into local comprehensive plans and regional planning documents to identify those natural areas deemed most vulnerable to climate change impacts including changes in sea level and rainfall patterns.
- d. Share acquisition priorities among planning and regulatory agencies
- e. Promote federal, state and local government conservation land acquisition programs that including fee simple and less-than-fee approaches to conserve natural areas, protect open space and create or maintain resilience and adaptive capacity by maintaining or creating connectivity among natural areas from the coast to inland/upslope.
- f. Following the model set by Monroe County, link rate of new construction permit issuance to conservation land acquisition rate.
- g. Monetize ecological services provided by natural systems and create a sustainable funding mechanism for their protection and management.



## Resource Management

Climate change will likely bring about more rapid introduction of exotics species. Some tools, such as prescribed fire, may become more difficult to implement. Management efforts may become more intense as lands are managed for certain vulnerable species. Regional cooperation among land management entities will become more essential.

- a. Coordinate regional invasive exotic species prevention and control efforts emphasizing prevention of new invasions and early detection/rapid response to nascent invasions.
- b. Coordinate regional fire management efforts emphasizing frequent, low intensity fire regimes in wetland and pine forest systems to maximize habitat quality, resilience to change and carbon neutrality while preventing fuel load build up that leads to major carbon releases.
- c. Coordinate “living shorelines” objectives at regional scale to foster use of green infrastructure (e.g. coral reefs and mangrove wetlands) instead of or in addition to grey infrastructure (e.g. bulkheads).
- d. Leverage existing work of the Florida Reef Resilience Program’s “Climate Change Action Plan for Florida’s Coral Reef System 2010-2015 for protection of marine habitat.
- e. Maintain natural resources critical to support the Region’s Largest Economic Sectors

## Migration & Species Diversity

- a. Identify potential species and habitat vulnerabilities to extremes in precipitation, including extended drought and intense storms, combined with higher temperatures.
- b. Examine water control structures to ensure that they can provide for inland or upstream migration of riparian species as freshwater habitats become more saline.
- c. With the assistance of climate models, maintain or restore multiple areas of habitat and large-scale connectivity to facilitate population stability and habitat shifts resulting from climate change.
- d. Minimize diversity and abundance of habitat-homogenizing exotic plant and animal species by monitoring for introductions, colonization, establishment, and connections with other populations.
- e. Engage and cooperate with marine resource agencies to maintain coral reef (e.g., selective breeding) and mangrove ecotones as estuarine habitat and natural barriers to storm surge for maintaining coastal biodiversity.

## Public Outreach

- a. Modify existing public outreach, education and engagement programs at natural areas (including upland, wetland, marine, coastal and nearshore environments) to include climate change mitigation and adaptation messaging and volunteer opportunities to enhance green infrastructure that will facilitate climate change resilience and adaptation.
- b. Initiate a regional public education campaign to educate residents, business owners, policy makers on the merits of preserving open land as an ‘insurance policy’ for adaptation to sea level rise in South Florida.

## **Agricultural Lands**

### Research

- a. Identify & secure research funding to include but not limited to:
  - i) Review and document freshwater marsh peat potential responses to saltwater intrusion.
  - ii) Monitor root-zone salinities and changes to vegetation communities. Adapt planning and management in response to surprises.
  - iii) Identify seagrass, mangrove, and coastal freshwater marsh environmental tolerances to changing factors such as salinity, water depth, substrate, and nutrients. Use this information with climate and hydrological modeling to aid management.
  - iv) Improve Florida Bay shallows bathymetry and use SLR and storm surge modeling to aid identification of habitats at risk.
  - v) Better identify linkages between marine system (e.g. coral reefs and mangrove wetlands) area/condition and hazard risk reduction.

### Policy

- a. Develop regulatory requirements that compatible dredge material may be utilized in the restoration of previously existing or establishment of new seagrass beds.
- b. Ensure that zoning regulations allow for the ability of plant and animal species to migrate inland as sea levels rise (e.g., limit armoring.) Ensure that land acquisition priorities consider landscape features which may limit species ability to migrate in response to sea level rise and other impacts related to climate change.
- c. Enforce Coastal Construction Line and Coastal High Hazard Area designations.
- d. Develop policies and regulations that will serve to reduce future risk and economic losses associated with sea-level rise and flooding in these designated areas through infrastructure improvements, insurance subsidization of high- hazard development and by directing development and growth to non-vulnerable areas.

## **Protected and Vulnerable Species**

In the coastal Everglades, higher elevation plant species may be at more of a risk from sea-level rise than the surrounding freshwater marsh because the marsh can migrate inland, but the upland berms are isolated and their dependent species have no path for migration. Twenty-one of the 43 critically imperiled species extant in Everglades National Park occur in the buttonwood forests coastal hammocks of the Everglades and Florida Keys. In all initiatives aimed at protecting the natural environment, first emphasize a broad ecosystem approach, then evaluate potential conflicts with specific protected resources. Where conflicts are recognized, attempt to resolve them with the least compromise to broad ecosystem values.

- a. Identify those narrow beaches lacking natural dunes which might possess high turtle-nesting density but which might also be prone to high nest mortality due to nest wash-out during more frequently expected storms and Identify more stable 'receiving' beaches to which nest may be relocated.

- b. Develop long-term turtle-nesting beach preservation strategies and methods in advance of anticipated coastal armoring which might result in loss of beach nesting habitat.
- c. Identify zoos, aquariums, herbariums and gardens that might be the repository for seed stock and captive breeding programs for those listed plants and animals under imminent threat of local extirpation due to sea-level rise.
- d. Compile species information for rare plant species in coastal hardwood hammocks and buttonwood forests and develop adaptation plans that include, at a minimum, seed bank repository collection and assisted propagation.

#### **Additional Language for Consideration:**

During the five years of this initial Regional Action Plan, those areas within the Southeast Florida region that have been deemed most vulnerable to impacts associated with sea-level rise based upon LiDAR mapping and vulnerability assessments, will be monitored for impacts. These impacts may be from extreme high tides, heavy local rain events, storm surge, or inadequate drainage systems. Those areas most impacted by these events will be considered for inclusion into one or more of the “Adaptation Action Areas”.

Climate change imposes long-term, continuous change on systems. Continuous changes make management goals a moving target and an observable systems response to actions under current conditions only a partial indicator of success. An adaptive management strategy must include preparation for long-term, often gradual changes with potential for large abrupt changes. Successful use of this strategy will require ecological and physical modeling to develop hypotheses and goals. Integration of directed research, management, and research-focused monitoring, risk assessment, and database management will be critical.

## **Transportation Working Group**

### **Focal Areas and Strategies**

The first focal area addresses adapting transportation infrastructure to the impacts of climate change as well as planning policies to guide prioritization and investment that take into account climate change impacts and emissions reductions. Incorporating climate change considerations into planning and project programming processes would provide the opportunity for transportation professionals and decision makers to develop the most cost effective strategies to best address the impacts of climate change on transportation infrastructure.

The next focal areas are strategies to reduce emissions and are organized by the following categories: alternative fuels and vehicle efficiency, system operation efficiencies, and vehicle miles traveled. Each area is often referred to as a leg of a stool, recognizing the importance of addressing all areas to achieve a balance, a strong foundation to build upon. Clearly, there is no silver bullet approach to reducing emissions; it will take a variety of approaches to achieve emissions reductions. Strategies to reduce vehicle miles traveled and provide for multiple modes of travel should be emphasized because of their long-term emissions reductions benefits and health and social benefits. This approach addresses the three pillars of sustainability and aligns with the Federal Livability Principles developed in 2009 to help guide transportation and other planning conducted at the local and regional levels and federal investment decisions.

A final focal area is dedicated to funding issues and federal policies and programs critical to the success of local and regional efforts.

## Focal Area 1

Develop strategies to evaluate risk, adapt the existing transportation infrastructure, and prioritize future investments that maximize resiliency and greenhouse gas (GHG) emissions reductions.

### Strategies

- 1) Identify means to effectively engage the multiple public and private sector entities with roles and responsibilities involving the provision and maintenance of transportation infrastructure and the delivery of transportation services in the region. Document current and evolving coordination efforts among these entities.
- 2) Work together to identify transportation infrastructure at risk from climate change in the region; determine whether, when, where, and to whom projected impacts from climate change might be significant. Employ inundation mapping, modeling and other appropriate tools to assess the vulnerability of transportation infrastructure to the projected impacts of climate change under various sea level rise and other climate change scenarios. At a minimum, assess the vulnerability of the following transportation infrastructure:
  - a) Local transportation networks of the Compact Counties
  - b) The tri-county Regional Transportation Network<sup>1</sup> designated by the Southeast Florida Transportation Council (SEFTC), which includes facilities that provide the highest level of mobility, strategic transportation facilities that are critical to region's economy and quality of life, including corridors (roadway, rail, waterway), airports, seaports, freight rail terminals, passenger rail and intercity bus terminals, and evacuation routes.
- 3) Develop adaptation actions that prioritize the people, places, and infrastructure most vulnerable to the projected impacts on the transportation network. Use a risk-management approach to adapt the existing network including criteria such as timing, likelihood, intensity of anticipated risks as well as costs relative to action versus inaction (description in the Circular on *Adapting Transportation to the Impacts of Climate Change State of the Practice 2011* <http://onlinepubs.trb.org/onlinepubs/circulars/ec152.pdf>. Best practices also available from NY, CA, and London.)
  - a) Develop regional priorities for short and long term maintenance and retention of the transportation network for a 50 year and a 100 year timeframe; evaluate the costs and benefits for maintenance and retention of existing transportation infrastructure, or construction, maintenance and retention of new infrastructure.
  - b) Address issues of inequality and environmental justice associated with climate change impacts and adaptation. Involve all parts of society in the development design and implementation of adaptation actions addressing the transportation network.
  - c) Identify those strategies that provide co-benefits, such as improving disaster preparedness, promoting sustainable resource management, and reducing GHG emissions including the development of cost-effective technologies.

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<sup>1</sup>SEFTC, Technical Memorandum #8: Regional Transportation Network, April 2010. This network for Miami-Dade, Broward and Palm Beach counties is composed of regional interstate and expressway facilities; major regional facilities (urban or rural principal arterial roadways and other roadways that cross county lines); regional connection facilities, regional facility designation extensions, Strategic Intermodal System hubs, corridors and connectors designated by the Florida Department of Transportation; adopted physical extensions of current regional facilities; and the statewide regional evacuation network with termini determined by the South Florida and Treasure Coast Regional Planning Councils and the state legislature.

4) Integrate consideration of climate change impacts and adaptation into the planning, operations, policies, and programs of local and regional transportation agencies.

a) Develop policy statements to incorporate the consideration of climate adaptation into planning processes and investment decisions and adopt the U.S. Department of Transportation's Guiding Principles for Climate Change Adaptation

- Adopt integrated approaches.
- Prioritize the most vulnerable.
- Use best-available science.
- Build strong partnerships.
- Apply risk-management methods and tools.
- Apply ecosystem-based approaches.
- Maximize mutual benefits.
- Continuously evaluate performance.

(<http://www.dot.gov/docs/climatepolicystatement.pdf> )

b) Develop policies to incorporate climate change adaptation strategies into hazard mitigation and post-disaster redevelopment planning.

c) Develop policies to address new transportation infrastructure development - to consider future floodplain conditions and vulnerable areas – e.g. rerouting of roads because of potential flood damage.

d) Modify or develop new design standards for transportation infrastructure located in identified vulnerable areas, e.g. asphalt concrete composition, bridge design, elevation, stormwater management. i.e. Include different pitches combined with stormwater design and/or use of more permeable surfaces to effectively remove water from the roadway; Explore roadway materials that may be utilized in road construction that are more tolerant to quick changes in hot or cold weather, or more tolerant of extended periods of extreme temperatures, in order to decrease repair costs, enhance safety, and increase longevity of road surfaces.

e) Develop and require a training program to educate professionals in relevant fields (e.g., architecture, engineering, and construction management) to incorporate adaptation to climate change as a basis for establishing design criteria for new transportation infrastructure. Completion of such training to be a condition for relicensing. (FL Energy & Climate Action Plan – Adaptation Strategies, pg. 8-7).

f) Consider the adoption of a “Green” road design and construction sustainability rating system. (Best practice research: NYDOT, University of Washington)

5) Focus investments and service expansions on strategies contributing to greenhouse gas emissions reductions and enhancing resilience to climate change.

a) Continue and enhance regionally coordinated transportation planning through the Regional Long Range Transportation Plan (RLRTP). Identify goals and objectives in the

RLRTP whose ultimate attainment reinforces the desired achievement of GHG emission reductions and enhancing resilience to climate change. Articulate the supportive role each objective has with respect to emissions reductions.

b) Transportation Investment Priorities. Give higher investment priority to transportation infrastructure, programs and services that will reduce greenhouse gas emissions. Performance standards for climate and related metrics, such as reduced VMT and increased mode split, should be incorporated in transportation and infrastructure programs.

i) Develop policies in local and regional planning processes to incorporate evaluation criteria and a process to rank and prioritize projects that meet plan goals and objectives, with an emphasis on those that reduce VMT and use of transportation modes other than the personal vehicle. Projects that enhance economic vitality should also be given priority, such as projects and service expansions along transit oriented corridors and those that improve connections to major airports and seaports. Develop performance measures related to climate change (i.e. VMT reduction) as a means to prioritize projects for funding.

c) Prioritize the funding of studies addressing effective adaptation and mitigation strategies, particularly those addressing barriers and assisting in integrating land use and transportation planning approach towards developing a transportation network that reduces vehicle miles traveled by ensuring transportation choices other than the use of personal vehicles.

e) Implement the recommendations in the RLRTP to incorporate/use modal prioritization tools.

6) Other

a) Develop early warning systems and social media applications (apps) to both inform residents and visitors of high-tide events and to raise overall awareness.

b) Identify incentives to encourage migration to less vulnerable areas.

**Additional language for consideration:**

Incorporate “Adaptation Action Area” designation into local comprehensive plans and the Regional Climate Change Action Plan for those areas within the Southeast Florida region that have been deemed most vulnerable to impacts associated with sea level rise. Within the “Adaptation Action Areas”, special regulations will be established to reduce or eliminate the potential for damage from flooding. During the five years of this initial Regional Action Plan, those areas within the Southeast Florida region that have been deemed most vulnerable to impacts associated with sea level rise based upon LiDAR mapping and vulnerability assessments, will be monitored for impacts. These impacts may be from extreme high tides, heavy local rain events, storm surge, or inadequate drainage systems. Those areas most impacted by these events will be considered for inclusion into one or more of the “Adaptation Action Areas”.



## Focal Area 2

Develop strategies to reduce GHG emissions through use of alternative fuels, vehicle and system operation efficiencies, vehicle miles traveled (VMT) reduction, and provision of multiple transportation choices.

### Strategies

#### Alternative Fuels & Vehicle Efficiency

1) Develop policies to create conditions for the development of alternative fuel (bio-diesel/ waste- based bio-diesel) and include these policies in regional plans and Local Comprehensive Plans. Incentivize and remove legislative, local code that may act as obstacle to stimulate the alternative energy industry.

*(Example: Plan and program infrastructure improvements for Electric Vehicle Infrastructure (EVI) in collaboration with local utilities. Policies should be developed to incentivize private deployment of infrastructure. Solar charging for electric vehicles should be prioritized to improve the community's emergency management preparedness in times of power outages.)*

2) Establish a working group of public and private stakeholders to develop a strategy to promote the use of Plug-in Electric Vehicles in the region.

a) Establish locations where infrastructure is needed. Solar charging options should be prioritized to maximize mitigation benefits and to improve the community's emergency management preparedness in times of power outages.

b) Develop policies to incentivize the deployment of infrastructure to complement transit oriented corridors. Reduced transit fares should be a consideration for riders accessing transit facilities by electric vehicles.

c) Work with relevant stakeholders to streamline permitting processes associated with charging equipment to encourage the safe and expeditious installation on customer premises and elsewhere.

d) Coordinate monetary and non-monetary incentives available to the general public and organizations purchasing electric vehicles.

3) Develop strategies to promote fuel efficient driving habits.

a) Conduct best practice research on existing campaigns and look for opportunities to integrate tools into existing high school, county and municipal driver education courses, traffic school curriculum, truck driver training, and fleet associations. [http://climatechange.transportation.org/ghg\\_itigation/operations.aspx](http://climatechange.transportation.org/ghg_itigation/operations.aspx) )

#### System Operation Efficiencies

1) Develop a toolbox of successful strategies to maximize the efficiency of the existing transportation network that have been used by partners in the region. When feasible information should include implementing steps, costs, and effectiveness of GHG emissions reductions. Some strategies to consider include the use of roundabouts, traffic signal prioritization for transit, queue jumps, etc.

2) Develop policies to facilitate and streamline the deployment of energy efficient and renewable energy such as the installation of LEDs and/or solar for public infrastructure such as street lighting, parks, parking facilities.

a) Survey counties and regional agencies with lighting infrastructure to determine the level of deployment and to gather best practice policies and implementation steps to facilitate the application of efficient lighting practices in additional infrastructure.

3) Develop a strategy for incentivizing the development of truck parking with electrification facilities and the use of auxiliary power units to reduce extended idling by trucks.

a) Survey transportation agencies (MPOs, FDOT, etc.) for existing studies identifying trucking patterns and needs.

b) Identify strategic locations for truck parking facilities and seek competitive funding opportunities as a region.

4) Develop policies to reduce the impact of transportation construction, maintenance, and agency operations - such as substituting fly ash for cement, using warm-mix instead of hot-mix asphalt- on GHG emission reduction, and require construction contractors to implement emissions reductions practices. Incorporate actions that reduce GHG emissions during project development and implementation, such as using recycled materials, incorporating low carbon cement mixtures, utilizing alternatively fueled vehicles, and purchasing locally or regionally manufactured materials.

5) Provide seamless transitions between transportation modes to increase the use of low carbon modes for the movement of people and freight in the region.

a) Improve connections between Tri-Rail and county transit service, municipal trolley and community shuttle bus services (may include re-alignment of routes). District circulators (Metro Mover in downtown Miami connects to Metro Rail) provide the last leg of a commute for transit riders and should have high frequency and ease of transfer.

*b) (Placeholder for regional freight strategies to integrate the many regional activities underway, e.g. periodic convening of regional freight summits providing opportunities to address that audience, development of a virtual freight network, studies exploring the potential for freight rail on a western corridor, etc.)*

c) Improve the transfers between transportation modes and move towards the delivery of a seamless fare media across the region.

d) Develop planning strategies to address planning for the “First and Last Mile” of transit trips.

#### Reduce Vehicle Miles Traveled and Promote Multiple Modes

Local communities with mixed-use developments and streets designed to encourage non-motorized modes of transportation are expected to reduce personal automobile trips. There is a need to connect those communities to corridors that link to regional employment centers and other destinations through low-carbon transportation options. The policies in this area will be developed to support the Federal Livability Principles which among other things emphasize the reduction of household transportation costs for people of all ages, incomes, races and ethnicities through reliable access to employment centers, educational opportunities, services and other basic needs.

## 1) Land Use Approaches.

- a) Require new development and redevelopment projects in existing and planned multimodal corridors and urban centers to be planned and designed to promote transit oriented development and transit use, which mixes residential, retail, office, open space and public uses in a pedestrian-friendly environment that promotes the use of rapid transit services.
- b) Develop policies to plan Transit Oriented Developments (TOD) along Transit Oriented Corridors (TOC). Consider the Regional Transportation Network in the development of potential TOCs. Develop policies to streamline the approval process for TODs.
- c) Explore expansion of activity based transportation modeling to more accurately predict, inform, and utilize transit trip data.
- d) Develop policies to improve the movement of non-motorized modes through the adoption of best practice models including Complete Streets.
  - i) Develop guidelines, models, and implementation projects to accelerate implementation.
  - ii) Identify partners and resources to support training and the research into new techniques for transportation design professionals.
- e) Modify local land use ordinances to encourage compact development patterns.
  - i) Adopt form-based codes or hybrid codes that use physical form, rather than separation of land uses, as their organizing principle and that take into consideration the urban transect or context zones.
  - ii) Consider regional implementation of rapid transit zones to maintain land use control around a station with multiple jurisdictions.
- f) Consider the adoption of green neighborhood certification programs to guide decision making and development and to provide an incentive for better location, design, and construction of new residential, commercial, and mixed-use developments.

## 2) Transit Options – Transit

- a) Study increasing service frequency on key routes and developing targeted transit routes, in the model of I-95 express to bring people directly from residential areas to regional centers of employment. Another example is “The Flyer” route from MIA to Miami Beach. Utilize existing studies of direct routes to inform this process.
- b) Leverage limited resources for campaign and promotional advertisements by coordinating regional public transportation messaging to attract “choice” riders. Messages should focus on making riding transit cool.
- c) Deploy social media applications, (apps) to facilitate use of transit including access to real-time information such as arrival times.
- d) Increase the amenities available to transit passengers, such as shade, shelters, kiosks, and real time boarding information.

## 3) Transportation Demand Management

a) Vanpool/Carpool programs - Work with MPOs and South Florida Commuter Services to identify opportunities to expand these programs.

b) Car & Bike Sharing Programs - Work with companies providing these services and strategic partners (universities, municipalities, large employers, etc.) to establish zip car, bike sharing and personal vehicle sharing programs.

#### 4) Bicycle Facilities

a) Prioritize implementation of planned bicycle and pedestrian networks. Evaluate whether these facilities are connected regionally and on a local scale to major employment, education, and recreation centers.

b) Implement roadway project checklist that includes measures of pedestrian and bicycle accommodation.

c) Consider regional adoption of Transit and Biking programs that aim to improve access to transit.

d) Develop policies to increase designated bike parking facilities at commercial and retail developments.

### Focal Area 3

#### Federal Policies needed to support local and regional efforts

1) Federal Surface Transportation Authorization. Support new authorization of the federal surface transportation programs with increased priority for funding public transit and non-motorized travel and integrated regional and metropolitan planning as means to reduce the greenhouse gas emissions from the transportation sector. The federal program needs to explicitly incorporate climate change and shift priorities toward programs that encourage reinvestment in existing infrastructure and communities ("fix-it-first" programs), support public transportation and transit-oriented development, and address congestion management through means other than road building.

2) Reform Transportation Models and Enhance NEPA Processes. To recognize when shifts are taking place in the true costs of road and transit, the surface transportation authorization legislation should encourage the development of up-to-date models and tools that measure the relative shifts in auto and transit costs, both up-front and on an operating basis as well as costs related to climate impacts and performance. Further, the U.S. Department of Transportation should be directed to develop ways and means to enhance the NEPA process in this regard as NEPA is central to all highways and transit project investment analysis.

3) Increase CAFE Standards. Establish stronger Corporate Average Fuel Economy (CAFE) Standards and enforce their adoption.

## **Appendix C - Contributing Technical and Staff Experts**

### **BUILT ENVIRONMENT WORK GROUP PARTICIPANTS**

|                     |  |
|---------------------|--|
| Steve Adams         | The Resource Innovation Group  |
| Jerry Allen         | Palm Beach County  |
| Olga Alvarez        | LEED Consulting & Green Practice Design                              |
| Ricardo Alvarez     | Florida Atlantic University  |
| Valerie Amor        | Drawing Conclusions LLC  |
| Glenn Amoruso       | Broward County   |
| Miguel Ascarrunz    | Broward County   |
| Steve Bassett       | Florida Energy and Climate Commission                                |
| Maria Batista       | Miami-Dade County Transit  |
| Barbara Blake Boy   | Broward County   |
| Gilberto Blanco     | Miami Dade Planning & Zoning   |
| Marina Blanco-Pape  | Miami-Dade County<br>Department of Environmental Resource Management |
| Richard Blattner    | City of Hollywood  |
| Fred Bloetscher     | Florida Atlantic University  |
| Marc Bruner         | Palm Beach County  |
| Donald Burgess      | Broward County<br>Natural Resources Planning and Management Division |
| Wayne Burns         | Broward County<br>Office of Economic and Small Business Development  |
| Ken Caban           | Tetrtech Consulting, South Florida Region                            |
| David Cabrera       | Broward County Facilities Maintenance Division                       |
| Bob Cambric         | South Florida Regional Planning Council                              |
| Al Carbon           | City of Fort Lauderdale  |
| Tyler Chappell      | Chappell Group   |
| David Chin          | University of Miami  |
| Ronald L. Crone     | Lake Worth Drainage District   |
| John Crouse         | Broward County   |
| Bryan Davis         | Palm Beach County  |
| Erin Deady          | Deady Law  |
| Ann Margaret Esnard | Florida Atlantic University  |
| Bonnie Finneran     | Palm Beach County  |
| Benjamin Franco     | Environmental Protection Agency                                      |
| Bob Freeman         | Environmental Protection Agency                                      |
| Tim Garling         | Broward County Transit   |
| Nancy Gassman       | Broward County<br>Natural Resources Planning and Management Division |
| Luciana Gonzalez    | City of Miami  |
| Debbie Griner       | Miami-Dade County<br>Department of Environmental Resource Management |
| Richard Grosso      | Nova Southeastern University   |
| Kevin Hart          | South Broward Drainage District                                      |

|                         |  |
|-------------------------|--|
| Nichole Hefty           | Miami-Dade County<br>Department of Environmental Resource Management |
| Carlos Hernandez        | Miami-Dade County<br>Department of Environmental Resource Management |
| Jill Horwitz            | Broward County<br>Natural Resources Planning and Management Division |
| Jennifer Jurado         | Broward County<br>Natural Resources Planning and Management Division |
| Anne Keller             | U.S. Environmental Protection Agency                                 |
| Glenn Landers           | U.S. Army Corps of Engineering                                       |
| Sandra Lee              | U.S. Green Building Council  |
| Gianni Lodi             | Miami-Dade County  |
| Barney McCoy            | Broward County Transit   |
| Jason McDonald          | U.S. Environmental Protection Agency                                 |
| Steve McGrew            | Palm Beach County  |
| Peter Merritt           | Treasure Coast Regional Planning Council                             |
| Gaspar Miranda          | Miami-Dade County Public Works                                       |
| Ray Misomali            | Miami-Dade County Office of Emergency Management                     |
| Ken Mitchell            | U.S. Environmental Protection Agency                                 |
| Carole Morris           | South Florida Water Management District                              |
| Jim Murley              | Florida Atlantic University  |
| Jayantha Obeysekera     | South Florida Water Management District                              |
| Danny Orlando           | U.S. Environmental Protection Agency                                 |
| Albert Perez            | City of Hollywood  |
| Elizabeth Plater-Zyberk | University of Miami  |
| Alan Powell             | U.S. Environmental Protection Agency                                 |
| Catherine Prince        | Miami Dade Planning & Zoning   |
| John Ramos              | Broward County Transit   |
| Bob Renken              | U.S. Geological Survey   |
| Jonathan Roberson       | Broward County Transportation  |
| Hector Samario          | U.S. Green Building Council  |
| Kim Shugar              | South Florida Water Management District                              |
| Henry Sniezek           | Broward County   |
| Norm Taylor             | Broward County   |
| Maurice Tobon           | Palm Beach County  |
| Richard Tornese         | Broward County   |
| Eduardo Vega            | Miami-Dade County Water and Sewer Department                         |
| Leonard Vialpando       | Broward County   |
| Tom Walker              | Florida Keys Aqueduct Authority                                      |
| Patti Webster           | Broward County<br>Natural Resources Planning and Management Division |
| Kevin Wilson            | Monroe County  |
| Lisa Wilson Davis       | City of Boca Raton   |
| Mike Zygnerski          | Broward County<br>Natural Resources Planning and Management Division |



## LAND AND NATURAL SYSTEMS WORK GROUP PARTICIPANTS

|                   |  |
|-------------------|--|
| Lorenzo Aghemo    | Palm Beach County Planning, Zoning & Building  |
| Albrey Arrington  | Loxahatchee River District   |
| Ken Banks         | Broward County<br>Natural Resources Planning and Management Division                   |
| Chris Bergh       | The Nature Conservancy   |
| Ronnie Best       | U.S. Geological Survey   |
| Julie Bishop      | Palm Beach County Environmental Resources Management                                   |
| Donald Burgess    | Broward County<br>Natural Resources Planning and Management Division                   |
| Billy Causey      | Natural Marine Sanctuaries   |
| Nancy Craig       | Broward County Environmental Monitoring Laboratory                                     |
| Chantal Collier   | Southeast Florida Coral Reef Initiative  |
| Janice Duquesnel  | Florida Department of Environmental Protection   |
| Sara Edge         | Florida Atlantic University  |
| Bonnie Finneran   | Palm Beach County Environmental Resources Management                                   |
| Bob Glazer        | Florida Fish and Wildlife Conservation Commission                                      |
| Cynthia Guerra    | Miami-Dade County<br>Department of Environmental Resources Management                  |
| Katie Halloran    | Miami-Dade County Planning and Zoning  |
| Isaac Hoyos       | Palm Beach County Department of Planning, Zoning and Building                          |
| Elizabeth Humple  | Broward County Environmental Monitoring Lab  |
| Dan Kimball       | Everglades National Park   |
| Thomas E. Lodge   | Ecological Advisors, Inc.  |
| Peter Merritt     | Treasure Coast Regional Planning Council   |
| Anne Morkill      | Florida Keys National Wildlife Refuge  |
| Sean Morton       | Florida Keys National Marine Sanctuary   |
| Jim Murley        | Florida Atlantic University  |
| Eric Myers        | Broward County<br>Natural Resources Planning and Management Division                   |
| Mark Nelson       | Jonathan Dickenson State Park  |
| Sylvia Pelizza    | Loxahatchee National Wildlife Refuge   |
| Leonard Perlstine | Everglades National Park   |
| Ronald Rice       | Cooperative Extension Service  |
| Robert Robbins    | Palm Beach County Environmental Resources Management                                   |
| Michael Roberts   | Monroe County  |
| Traci Romine      | Audubon of Florida   |
| Barry Rosen       | U.S. Geological Survey   |
| Winnie Said       | South Florida Water Management District<br>Hydrologic & Environmental Systems Modeling |
| Jim Schuette      | DuPuis Management Area<br>South Florida Water Management District                      |
| Fred Sklar        | South Florida Water Management District  |
| Steve Traxler     | U.S. Fish & Wildlife Service   |
| Katherine Tzadik  | Florida Department of Environmental Protection   |
| Tom Van Lent      | Everglades Foundation  |
| Richard Walesky   | Palm Beach County  |
| Patti Webster     | Broward County<br>Natural Resources Planning and Management Division                   |

## **TRANSPORTATION WORK GROUP PARTICIPANTS**

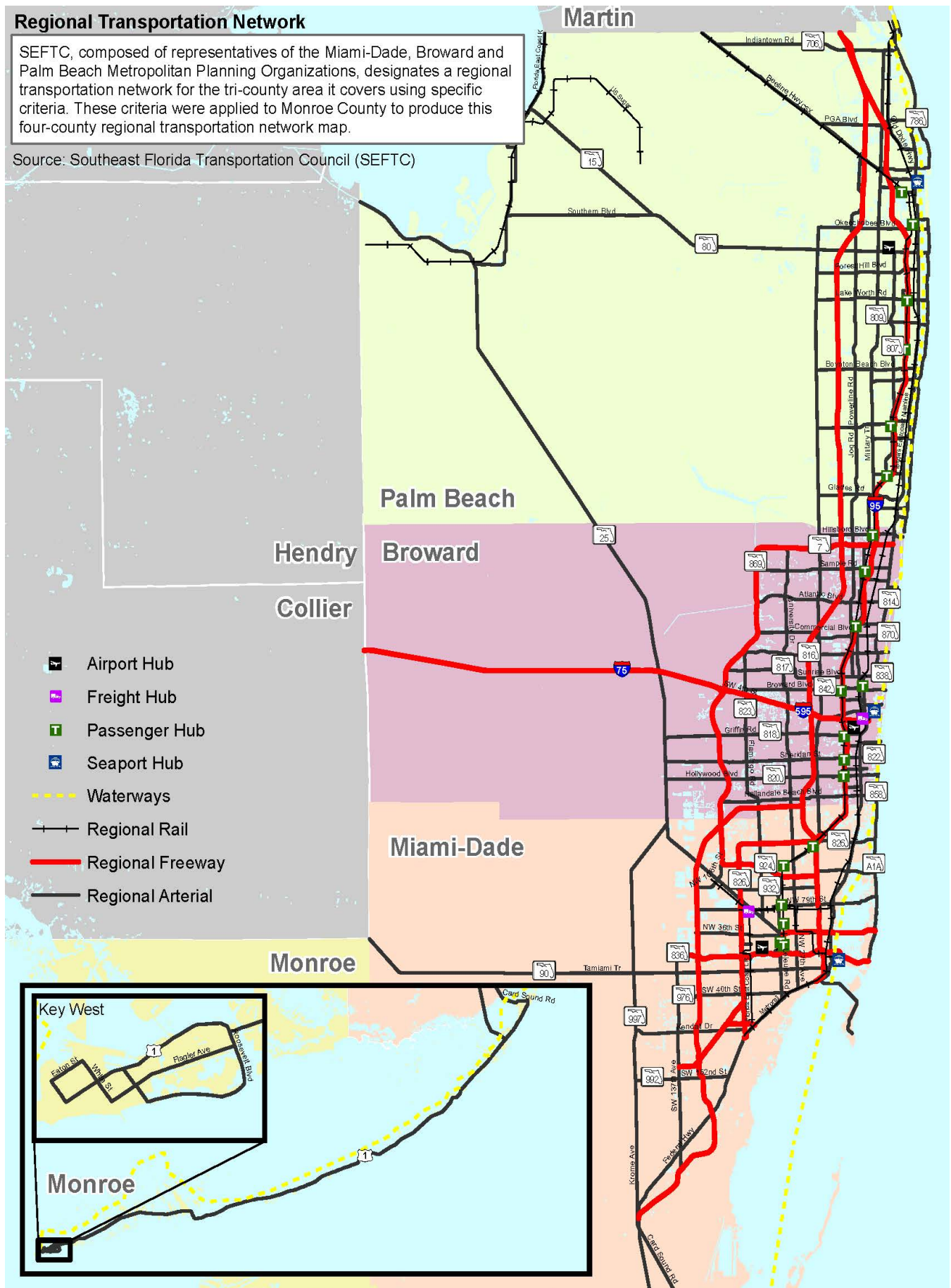
|                      |  |
|----------------------|--|
| Lorenzo Aghemo       | Palm Beach County Planning   |
| Frederick Bloetscher | Florida Atlantic University  |
| Donald Burgess       | Broward County<br>Natural Resources Planning and Management Division                         |
| Lois Bush            | Florida Department of Transportation – District 4  |
| Rita Carbonell       | Miami-Dade Expressway Authority  |
| Steve Carrier        | Engineering and Public Works   |
| Monica Cejas         | Miami-Dade County Transit  |
| Carla Coleman        | Urban Land Institute   |
| Antonio Cotarelo     | Miami-Dade County Public Works   |
| James Cromar         | Broward Metropolitan Planning Organization   |
| William Cross        | South Florida Regional Transportation Authority - Tri Rail                                   |
| Tim Garling          | Broward County Transit   |
| Andrew Georgiadis    | Dover Kohl & Partners  |
| Debbie Griner        | Miami-Dade County Department of<br>Environmental Resources Management Air Quality Management |
| Nichole Hefty        | Miami-Dade County<br>Department of Environmental Resources Management                        |
| Christine Heshmati   | South Florida Regional Planning Council  |
| Becky Hope           | Miami-Dade County Seaport  |
| John Morgan          | South Florida Water Management District  |
| Catherine Prince     | Miami-Dade County Department of Planning and Zoning  |
| Jarice Rodriguez     | Florida Atlantic University  |
| Napolean Somoza      | Miami-Dade County Department of Planning and Zoning  |
| Gregory Stuart       | Broward Metropolitan Planning Organization   |
| Susanne Torriente    | Miami-Dade County Office of Sustainability   |
| Paul Vitro           | Miami-Dade Emergency Management  |
| Jeff Weidner         | Florida Department of Transportation – District 4  |
| Lynda Westin         | Southeast Florida Regional Transportation  |
| Enrique Zelaya       | Broward County Transportation Planning   |

## Appendix D - Regional Transportation Network

### Regional Transportation Network

SEFTC, composed of representatives of the Miami-Dade, Broward and Palm Beach Metropolitan Planning Organizations, designates a regional transportation network for the tri-county area it covers using specific criteria. These criteria were applied to Monroe County to produce this four-county regional transportation network map.

Source: Southeast Florida Transportation Council (SEFTC)



## IX. Supporting Documents

The following support documents from the Southeast Florida Regional Climate Change Compact are available on the Compact website at:

[southeastfloridaclimatecompact.org](http://southeastfloridaclimatecompact.org)

- A. Regional Climate Action Plan Implementation Guide
- B. Compact Counties' Policy and Advocacy Implementation Report
- C. Regional Greenhouse Gas Emissions Inventory Baseline Period: 2005 – 2009
- D. A Unified Sea Level Rise Projection for Southeast Florida
- E. Analysis of the Vulnerability of Southeast Florida to Sea Level Rise

The White Paper on Adaptation Action Areas by the Florida Department of Economic Opportunity (Support Document F) is also available on the Compact website.

## Photo Credits

|               |  |
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| Page 44:      | Compact press conference after BP spill, provided by Broward County<br>From left to right: Monroe County Commissioner George Neugent, Miami-Dade County Commissioner Katy Sorenson, Palm Beach County Commissioner Shelley Vana, and Broward County Commissioner Kristin Jacobs. |
| Page 51:      | People exiting South Beach bus, provided by Miami-Dade County  |
| Back Cover:   | Mom and son at beach, provided by Miami-Dade County  |



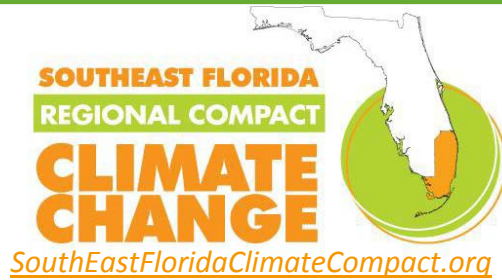


**SOUTHEAST FLORIDA  
REGIONAL COMPACT  
CLIMATE  
CHANGE**



This document was produced by the Southeast Florida Regional Climate Change Compact, a regional collaborative including Broward, Miami-Dade, Monroe and Palm Beach Counties, and promulgated at a cost of \$4,634 or \$6.62 per copy, for the purpose of providing information on climate change planning strategies relevant to Southeast Florida.





## What is the Southeast Florida Regional Climate Change Compact?

The Compact is an agreement adopted by the Broward, Miami-Dade, Monroe and Palm Beach County

**"This is a great model of a partnership and there will be a lot of us looking to promulgate this as a model."**

*- Margaret Davidson, Director, NOAA Coastal Science Center, Dec. 9, 2011*

Commissions in January 2010. The counties recognized the vulnerability of the Southeast Florida region to the impacts of climate change and resolved to **work collaboratively on mitigation and adaptation strategies** such as joint policies to influence climate/energy legislation and funding at state and federal levels, **developing a Regional Climate Change Action Plan**, and hosting annual summits to review progress and discuss strategies.

## How did it get started?

Representatives of the four County Commissions came together at the 2009 Southeast Florida Regional Climate Leadership Summit hosted by Broward County. The representative discussed regional challenges and **threats from global climate change on the 5.9 million residents** of this region, and a call to action for regionalized efforts was issued in the form of the Compact.



## What's been accomplished to date?

Following the October 2009 summit, the Compact formed a Staff Steering Committee with representatives from each of the Compact Counties and the 109 cities of the region, as well as ex-officio advice from regional entities such as the South Florida Water Management District, South Florida Regional Planning Council, and others.

Federal and state legislative programs were coordinated in 2010-2013. This led the state legislature to **create the Adaptation Action Area (AAA) designation for areas uniquely vulnerable to climate impacts**, including sea level rise, to serve as a planning tool and encourage technical assistance and funding opportunities.

With the support of a variety of local, regional, state, and federal agencies (NOAA, USACE, USGS, and USEPA), **the Compact developed a technical foundation for regional climate issues**.

Finally, with the input of myriad stakeholders, the draft Southeast Florida Regional Climate Action Plan (RCAP) was developed in December 2011. The RCAP was finalized in October 2012 after incorporating stakeholder feedback. **The RCAP's 110 action items aim to reduce greenhouse gas emissions and adapt to the effects of climate change over the next five years.** The document was formally adopted by all Compact Counties in the spring of 2014. Ongoing workshops to aid in the implementation of the RCAP's 110 action items began in 2013.



**"...no region in the country has tried to tackle climate change on the same scale as what the four South Florida counties propose, according to Ron Sims, former secretary of U.S. Housing and Urban Development."** - Andy Reid, Sun Sentinel and Huffington Post Miami, Dec. 7, 2012

## Who's taking notice?

The efforts of the Compact's four counties have garnered attention from a variety of local, national and international sources. Here are a few examples.

- **THE WHITE HOUSE:** In 2009, the White House requested a white paper on the Compact. The region was then chosen for a White House Council on Environmental Quality listening session held June 23, 2010. Compact efforts have been highlighted in the Progress Report of the Interagency Climate Change Adaptation Task Force, and in 2013 Broward County Commissioner Kristin Jacobs was appointed to President's Task Force on Climate Preparedness and Resilience. Two other staff steering members were also recognized as Champions of Change by the White House.
- **MEDIA:** Coverage on the Compact has appeared in every major local paper in the region and at the national level on ClimateWire, Bloomberg News, Climate Central, CNN, New York Times and Rolling Stone.
- **ACADEMIA:** FAU, UM, FIU and other local universities are working with the Compact to advance climate science and assessment tools. The Massachusetts Institute of Technology (MIT) focused a semester-long graduate student class on exploring our vulnerability to sea level rise using the tools developed locally. Yale published an extensive article on the topic, and Yale's Cultural Cognition Project is currently assisting in implementation.
- **FEDERAL LEGISLATORS:** Members of Congress on May 13, 2011, urged the inclusion of Adaptation Action Area designation into the US Army Corps of Engineers' Operations & Maintenance account. In 2012, the Compact was highlighted by the Senate as an example of local response. In 2013, three of four compact county mayors and all staff steering committee mayors submitted a joint letter to the Bicameral Task Force on Climate Change proposing ways federal government could help local governments and regions.
- **NACo:** The Compact Counties received recognition also came from the NACo Achievement Award in 2010 for conducting the Southeast Florida Regional Climate Leadership Summit and in 2011 for progress implementing the Compact.
- **NATIONAL CLIMATE ASSESSMENT:** The Compact is highlighted in the draft assessment as an excellent example of regional cooperation in addressing the challenges of climate change and sea level rise.
- **KRESGE FOUNDATION:** In late 2012, the Kresge Foundation awarded a three-year, \$975,000 grant to the Institute for Sustainable Communities to support the implementation of the RCAP.

**"County governments estimate that the damages could rise to billions or even trillions of dollars. In and around Miami, local officials are grappling head on with the problem."**

*— Coral Davenport, New York Times, May 7, 2014*

## What's next?

The Compact members and participants look forward to another productive year of regional collaboration and will continue to seek opportunities to bring additional funding and resources to the region for climate change mitigation and adaptation activities. Activities for the coming year include:

- Implementation of the RCAP with the Yale Cultural Cognition Project, support from the Institute of Sustainable Communities and funding from the Kresge Foundation.
- Engagement of the region's 109 municipal partners through the Mayors' Climate Action Pledge.
- Advocacy for the 2014 State and Federal Energy and Climate Legislative Program.
- Supporting the Adaptation Action Area pilot project in partnership with Fort Lauderdale, Broward County, South Florida Regional Planning Commission and Florida Department of Economic Opportunity.

Each of the Compact partners is moving forward to implement greenhouse gas mitigation and climate adaptation strategies. Working with municipal partners, key strategies are advancing to create a more economically competitive and climate-resilient community.



# City of Miami

## Legislation

### Resolution: R-16-0230

City Hall  
3500 Pan American  
Drive  
Miami, FL 33133  
www.miamigov.com

File Number: 16-00638

Final Action Date: 5/12/2016

A RESOLUTION OF THE MIAMI CITY COMMISSION DIRECTING THE SEA LEVEL RISE COMMITTEE AND THE WATERFRONT ADVISORY BOARD TO REVIEW THE UNIVERSITY OF MIAMI'S 2016 CLIMATE CHANGE SPECIAL REPORT AND REPORT THEIR FINDINGS TO THE CITY COMMISSION WITHIN NINETY (90) DAYS.

WHEREAS, pursuant to Resolution No. 15-0072, the City established the City of Miami Sea Level Rise Committee ("Sea Level Rise Committee"), whose duties are, *inter alia*, "To serve in an advisory capacity to the City Commission and recommend any changes to City of Miami ("City") policy to help the City better combat the deleterious effects of sea level rise"; and

WHEREAS, pursuant to Section 29-122 of the City Code, the City's Waterfront Advisory Board is tasked with, *inter alia*, "provid[ing] advice to the City Commission concerning those issues and only such other matters as are referred to it by the City Commission in regard to City or public land abutting water"; and

WHEREAS, the University of Miami ("UM") has issued the UM Special Report, summarizing various challenges posed by climate change and potential mitigation solutions; and

WHEREAS, the City Commission wishes for the above mentioned Sea Level Rise Committee and Waterfront Advisory Board to review said report and report their findings to the City Commission within ninety (90) days;

NOW, THEREFORE, BE IT RESOLVED, BY THE COMMISSION OF THE CITY OF MIAMI, FLORIDA:

Section 1. The recitals and findings contained in the Preamble to this Resolution are adopted by reference and incorporated as fully set forth in this Section.

Section 2. The Sea Level Rise Committee and the Waterfront Advisory Board are directed to review the University of Miami's 2016 Climate Change Special Report and report their findings to the City Commission within ninety (90) days.

Section 3. This Resolution shall become effective immediately upon its adoption and signature of the Mayor. {1}

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Footnotes:

{1} If the Mayor does not sign this Resolution, it shall become effective at the end of ten (10) calendar days from the date it was passed and adopted. If the Mayor vetoes this Resolution, it shall become effective immediately upon override of the veto by the City Commission.